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ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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No. 1

ORIGINAL MEMOIRS.

GASTROCOLOPTOSIS.*

ITS PATHOLOGICAL SIGNIFICATION AND ITS SURGICAL TREATMENT.

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I. PATHOLOGICAL SIGNIFICATION.

FOR the subject of this paper I have chosen a question upon which American and Danish surgeons have for many years worked with the same object in view, and, in principal, with the same methods. While the majority of the surgeons of Europe and almost the entire medical world have no comprehension of the enormous pathological significance of gastrocoloptosis nor, in consequence, of the therapeutic problems which here present themselves, gradually, every one has now begun to agree about one thing: that a large number of those individuals with whom one finds gastropotosis and coloptosis suffer to a great extent from a series of symptoms of which constipation is the first and most constant, while cardi-algia, vomitings, emaciation, and a host of nervous symptoms are added little by little, and complete the aspect of the disease of these wretched patients. But here unanimity ceases, because, while I and probably all, who are votaries of a surgical therapy with the severe cases of ptosis, regard the above-

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mentioned morbid symptoms as a result of the ptosis, the others regard the ptosis as an irrelevant, co-ordinate symptom. This difference of opinion corresponds with and rests on the diversity which prevails in the conception of the pathogeny of enteroptosis. Essentially there are two theories which have governed the medical men's conception of ptosis as a secondary, rather insignificant phenomenon: the one, Glénard's theory, tends to show that enteroptosis is the result of an enigmatic nutritive disease, a "diathèse hépatique," which involves atrophy and prolapse of the small intestines, whereby the organs lying above lose their support, which secondarily leads to gastropptosis, hepatoptosis, etc. This theory has now been abandoned by most in favor of Stiller's hypothesis which, in place of Glénard's mysterious liver-disease, sets up a so-called congenital, universal asthenia, a congenital weakness, laxity, and gracility of the entire structure of the body, as of the individual tissues. The ptosis and the constipation should be due to laxity and atony of the tissues, the pains and the nervous symptoms to neurasthenia—the whole simply being a manifestation of degeneration, and, as degeneration cannot be cured, it is natural that all votaries of this doctrine must regard a surgical therapy for enteroptosis as senseless.

I think, however, that one is justified in expressing a certain wonder that Stiller's hypothesis is accepted unreservedly and without criticism by the majority of physicians the world over, because there is one fact, which, even where Stiller's theory is regarded quite superficially, seems to deliver a *coup-de-grâce*. It is the circumstance *that enteroptosis is so rare with men and so very frequent with women that it must almost be considered a feminine disease par excellence*. But even the most conceited and discourteous of men will not insist on this degeneration being reserved for women. Unfortunately we certainly have to admit that, in this respect, the two sexes have nothing to reproach each other with. Nor is there any lack of thin, badly built, neurasthenic men; but it is very seldom that these suffer from constipation and the dyspeptic symptoms which characterize the ptosis patients.

Simple logic tells us, therefore, that Stiller's theory is in the main at fault, and tells us to look around for another explanation of the overwhelming frequency of ptosis with women. In my opinion a very simple explanation is found in two circumstances peculiar to women: (1) their misuse of corsets and lacings, and (2) the changes which pregnancy and childbirth involve in the intra-abdominal pressure. Here we have the two momenta which fully explain enteroptosis as a feminine disease par excellence: the one causes an active subsidence of the subdiaphragmatic organs and stretches and lengthens the suspensory ligaments, while the other removes that support which the intestines, when compressed by a vigorous abdominal wall, offer the subdiaphragmatic organs. The two Russian investigators, Wolkow and Delitzin, are surely right when in their excellent work on nephroptosis they compare the small intestines to an air-filled pelotte which, so long as it is supported by the elastic pressure of a vigorous muscular abdominal wall, bears up the subdiaphragmatic organs: the stomach, the liver, and the kidneys. When, after many childbirths, the abdominal wall becomes like a sort of slack bag into which the small intestines subside, then the organs mentioned not only lose their support but are dragged, sucked, and drawn downward. Their power of resistance against this then depends entirely on the firmness and solidity of the ligaments and peritoneal duplicatures by which they are attached to the diaphragm. If these are feeble, thin, and atrophied as with Stiller's degenerated type of mankind, or lengthened by the use of corsets and lacing, and the organs forced down, the ptosis proceeds rapidly,

Of Stiller's theory, then, there remains only this: that the corset and lace pressure, when brought to bear upon quite young, half-grown girls with soft, relaxable ribs, naturally has specially easy play with the degenerative type, the bones and tissues of whom are particularly relaxable and flaccid. Among ptosis patients we therefore find many of this female type represented, and this explains, to a certain extent, the origin of the theory, but is no excuse for the complete regard

which has been paid to it, because, for that ptosis is a too frequent phenomenon with originally quite normal women.

The rare cases of ptosis with men almost all occur with men of Stiller's type, men with a feeble bone and muscle structure, and then generally with men who have used tightly buckled belts.

But if we have thus had to abandon the theory of degenerative universal asthenia as the cause of the ptoses, then we must also abandon the idea of constipation, cardialgia, vomitings, emaciation, nervous symptoms, etc., being the outcome of "degenerative asthenia." It is most natural, therefore, to ascertain whether all these symptoms cannot be explained as pains released and caused by the ptosis itself.

Even in that article in "Hospitallstidende," in which in 1898 I reported my first case of gastropexy, which led to a permanent cure of the considerable sufferings of this ptosis patient, I set forth in its main features the conception that all the morbid symptoms and conditions which we find typical in patients with enteroptosis allow themselves naturally and spontaneously to be explained as a result of the ptosis. The correctness of this conception has only been confirmed by the observation and study of the 400 cases which I have personally treated, the statistics of which are embodied in the present communication.

In order to substantiate this, I shall give a short description of the aspect of the typical symptoms which I have found with gastropotosis, and of their development.

Confining the discussion, for the present, to gastrocoloptosis with women, I discriminate between two principal groups, which, both as regards the pathogeny and the symptomatology, are rather sharply distinguished from each other; they are *virginal* ptosis and *maternal* ptosis.

II. VIRGINAL GASTROCOLOPTOSIS.

Symptomatology.—In the course of the first or second year after the commencement of puberty, and when the wearing of corsets commences, the previously healthy individual

begins to suffer from *persistent constipation*, whereto are quickly added weariness, headache, loathing of food. In addition to these symptoms there occurs after some time cardialgia, in the form of severe pains which are always situated to the left of the centre line and occur as soon as the patient partakes of food. The quality of the food has no significance so far as the rise of these pains is concerned, whereas the quantity—the mass and weight of the food—is of great importance, for which reason these patients can only get along by taking many quite small meals during the 24 hours. In many instances the commencement of the pains is accompanied by vomiting, and with a smallish group of these patients each meal was invariably and immediately succeeded by the discharge of a part or the whole of the food partaken of. In the first instance, the patients may maintain an astonishingly healthy appearance for many years; but if they disgorge everything, and are furthermore frightened by fear of the pains from attempting to eat, emaciation sets in, which may often reach an extreme stage and present that aspect which I have called gastropstosis-cachexia, and which may result in the death of the patient as a consequence of inanition.

By examining the chemical function of the stomach one generally finds that the measure of acidity is normal, but in a certain number of cases one finds achylia, and in others, conversely, hyperacidity and even gastrosuccorrhœa.

In more than half of the cases the motor function is completely normal, inasmuch as the stomach empties itself entirely in the course of 4–5 hours. In 30–40 per cent. of the cases there is a slight delay (5–7 hours), while food remains are rarely found 8 hours after one of Bourget's experimental meals.

With many of these patients a whole series of nervous symptoms develop gradually as a result of this state of auto-intoxication and inanition, such as oppression across the loins, in the pelvis and the abdomen, clammy hands and feet, palpitation of the heart, physical depression; with some a mental relaxation and with others a sensation of dread.

Finally disturbances in the function of the genital organs develop very rapidly, because the menstruation becomes irregular and is accompanied by diffuse pains in the abdomen and a deterioration of the regular symptoms. The menstruation is frequently very deficient, and for years may entirely fail to appear.

The *pathogenesis* of this disease as shown by its symptoms is, in my opinion, as follows: the lacing up of the young girls' gracile, easily relaxing, and plastic body in corsets involves an increasing deformation and straitening of the lowest thorax aperture. This results in a shifting of the subdiaphragmatic organs. First of all the pressure acts upon the massive liver, and this again by its great weight serves to dislocate the organs lying below. Paul Hertz has shown us in a very fine manner how nephroptosis arises from corset pressure, because this utilizes the liver as a lever to tilt the right kidney out of its niche, and we therefore understand why in the majority of cases the floating kidney is only on the right side. But to what a still greater extent, and how more invariably must not the effect of the corset pressure on the liver extend to the stomach?

It is clear that if the liver is pushed down the stomach must follow suit, and hereby the œsophagus, the gastrophrenic ligament, and the cardial peritoneal covering *in toto* are stretched in a manner which corresponds with the extent of the subsidence. In this I perceive the cause of the invariable pains in the left side of the epigastrium, of which these patients always complain when they are up and doing, and especially so during meals. But, in addition, the posterior edge of the gastrohepatic and hepaticoduodenal ligaments must also become lengthened and dislocated. Together with the stomach, the transverse colon is pushed down, whereby more or less acute angled bends occur at the points of fixation at the hepatic flexure and the splenic flexure. This involves a hindrance of the passage of the fæces from the colon ascendens to the colon transversum; and, if they enter the latter, they will again be retained here for an abnormally long time, and then

the hard, gnarled fæces still further and continuously weigh down the transverse colon. Hence the ever increasing constipation.

I look for the cause of the virginal ptosis patients suffering so much more than the maternal ptosis patients do from pains and vomitings after meals to the circumstance that the tight abdominal wall and the narrow abdominal cavity do not permit of the free subsidence of the loosened organs. The result is that the stomach as well as the colon fold themselves transversely with the longitudinal axis, and breaks and bends occur which hinder the natural passage of the food and produce stasis and pains. The fact of the matter is, that all the vessels and nerves to the stomach from the large vessel- and nerve-roots have their course just between the peritoneal layers, which either form the suspensory ligaments or cover these. They form, so to say, an integral part of the suspensory ligaments and, when these are folded, are also subject to bends and folds, and when the ligaments are stretched and lengthened by the subsidence of the stomach a considerable drag is also exercised on the vessels and nerves. That such a distention of the sympathetic fibres and thereby of the ganglion coeliacum and of nervi-vagi, which, with the œsophagus, extend into the thorax cavity, cannot fail to affect the activity of these nerves seems evident, and here, surely, is to be found the explanation of many of the nervous symptoms of these patients. As regards the invariable pains in the left side of the epigastrium, it seems to me that these are explained naturally as having their origin in the drag on the sensitive nerves which have their course in the subperitoneal tissues.

In these conditions we have a simple explanation of the pains and disgorgements of the virginal ptosis patients immediately after partaking of food; and, if these symptoms become invariable, the consequent results are emaciation and waste of fatty and other tissues in the abdominal organs, which makes room in the abdomen for a further subsidence of the sub-diaphragmatic organs, and makes the suspensory ligaments of these thinner and more relaxable. But, by this the subsidence

of the colon is increased, and the constipation by degrees becomes more obstinate. With the resorption of the stagnant fæces a poisoning of the organism arises—autointoxication; but this is not all, because the stagnation in the large intestine reacts on the function of the small intestine. The passage through the small intestine takes place more slowly, and, in certain cases, a real stasis may even occur in this. This may perhaps, as assumed by Lane, be due to bends in the small intestine at its points of fixation (the duodenal kink and the iliac kink) where the subsided part of the intestine joins the fixed part; or, as Knud Lunn thinks, may be only a result of the constipation, especially where *valvula Bauhini* are deficient.

According to Lunn's observations, then, it seems as if the stasis is transmitted to the stomach, and we then get the delayed emptying of this, five to seven hours after the meal, which often occurs with gastropotosis patients, and which is interpreted by certain authors as a "primary atony," and even by Stiller is considered as being the cause of the ptosis.

The view of the matter is entirely beyond the point, because in more than half of the cases of gastropotosis the emptying is perfectly normal. The delayed emptying, on the contrary, which occurs with the minority of ptosis patients seems to me rather to be explained naturally by the difficult conditions of passage in the large and small intestines.

The *diagnosis* of the virginal ptosis is generally not difficult for him who has once had his eyes opened to the peculiarities of the aspect of the disease, but for him who has not it offers many difficulties and stumbling blocks. Certain it is that few diseases are so frequently misinterpreted as this. The three wrong diagnoses under the flag of which virginal ptosis most frequently sails are (1) *ulcus ventriculi*, (2) *colitis*, and (3) *nervous disease of the stomach or hysteria*.

Those cases where violent cardialgia and vomitings occur as an immediate result of meals and dominate the aspect are naturally confounded with *ulcus ventriculi*. This confusion happens all the more easily because the violent and frequent vomitings by no means rarely show streaks of blood, or even

such a strong admixture of blood that they assume the character of hæmatemesis. The presence of constipation, indeed, only strengthens the diagnosis, because it is so often a symptom with ulcer.

In addition to this the examination of the position of the stomach by scraping auscultation, or by Röntgenoscopy after a bismuth meal often reveals a subsidence which is inferior in proportion to the acute symptoms. With most cases, this seems to controvert the diagnosis, inasmuch as these cases mean quite plainly that the acuteness of the symptoms must be proportionate with the degree of the extent of the subsidence. Not until one has realized that it is just the circumscribed conditions of space which hinder the pressed-down stomach from freely sinking down and, on the contrary, jam it between the tight abdominal wall, the spinal column and the other abdominal organs, and force it to place itself in bends and folds, does one understand that these very circumstances, in spite of the apparently minor ptosis, produce such acute symptoms.

The differential diagnosis from ulcer is, as a rule, easily determined from the following facts: (1) *The seat of the cardialgia* being to the left of the centre line, (2) that the cardialgia does not depend on the quality of the food, but does on the quantity of this. An ulcer patient suffers pain from eating rich, sour, spiced food, no matter how small the quantity, but stands milk; while a ptosis patient stands all such food equally well so long as the quantities are quite small, but suffers severe pain from milk and other neutral food when the quantity is too large.

(3) *The influence which the position of the body has upon the symptoms.* These always are worse in an upright position, and always improve and often disappear entirely only with confinement to bed.

The cases where constipation dominates the aspect of the disease, while the stomachic symptoms are comparatively minor, are often confounded with colitis. In many cases the confusion is promoted by this, that the constipation involves

in reality a colitis with periodically occurring diarrhoea. Here, also, it is a differential diagnostic symptom of great value: that with ptosis, confinement to bed has a highly favorable effect on the constipation; while constipation arising from other causes generally becomes more marked with confinement to bed.

The diagnosis hysteria and nervous disease of the stomach is generally given with such patients as have for a long time been vainly treated with ulcer-therapy or anticonstipation treatment, partly because their having been vainly treated for a supposed organic disease leads to the diagnosis of functional neurosis, and partly because these patients, little by little, on account of their protracted sufferings and the fruitless treatment, become in a great degree psychically exhausted and nervous individuals. The differential diagnosis from hysteria is, however, by no means difficult, when one analyzes the history and the aspect of the disease; because it then always appears that constipation and dyspepsia have been the first symptoms and still constitute the central feature in the aspect of the disease. Scraping auscultation and Röntgenoscopy show us the presence of the ptosis, and, finally, an exact examination shows that really hysterical stigmata are practically always wanting.

More rarely the pure ptosis is confused with cancer. This happens with those patients who have become completely emaciated by vomitings and abhorrence of food, lasting over many years, and who have acquired a cachectic complexion from the autointoxication arising from the stagnating contents of the large intestine.

Complications and Consequent Diseases.—Some of my observations indicate that the traction on the œsophagus of the subsided stomach may involve a difficulty with the swallowing and passing of the food, and thereby, also, changes in the œsophagus itself. It is peculiar to a rather numerous group of patients with virginal ptosis that they either permanently or periodically, especially when in an erect position, disgorge the food immediately after swallowing it. In other instances

I have observed the trouble with swallowing to be so serious that the patients have been admitted for stricture of the œsophagus. That these cases are really due to the traction of the stomach on the œsophagus seems proved by this, that the symptoms mentioned disappeared immediately and completely in all the cases after gastropexy or after the employment of an effective supporting belt.

As regards the stomach itself, the folds and bends mentioned, which, with virginal ptosis especially, are the result of the narrow space, give rise to serious and interesting complications and to the consequent conditions.

I have already mentioned that, even where no trace of ulcer can be proved at the operation, hæmatemeses are not quite infrequent with gastropsis. Such hæmatemeses are probably due to stasis in and swelling of the mucous membrane at the places where the wall of the stomach is creased.

Finally, in a certain number of cases, the virginal ptosis leads to the development of an hour-glass stomach. I think, indeed, that I dare assert that the solution of the so long disputed question of the pathogenesis of the hour-glass stomach is to be sought for in the fixation of the creases of the prolapsed stomach caused by corsets and laces. The two theories which have hitherto stood in opposition to each other are, as is known, the conception that the hour-glass stomach is a congenital deformity as opposed to the ulcer-theory, according to which the hour-glass form should be due to cicatricial shrinkage. Without venturing to deny the justifiableness of these two explanations with individual cases, I venture distinctly to insist that neither of them can be accepted as accounting for the great number of this, astonishingly frequent disease; because, if a congenital hour-glass is proved at all, it is proved, at the highest computation, only in one or two cases, of which the demonstrative force is doubted even by Moynihan, the advocate of the ulcer-theory. Now, as regards this, it may, when considered superficially, seem to be well founded in the fact that, with an hour-glass stomach, ulcerations or cicatrices are often found on the partition wall.

But further reflection shows that the theory does not stand the test.

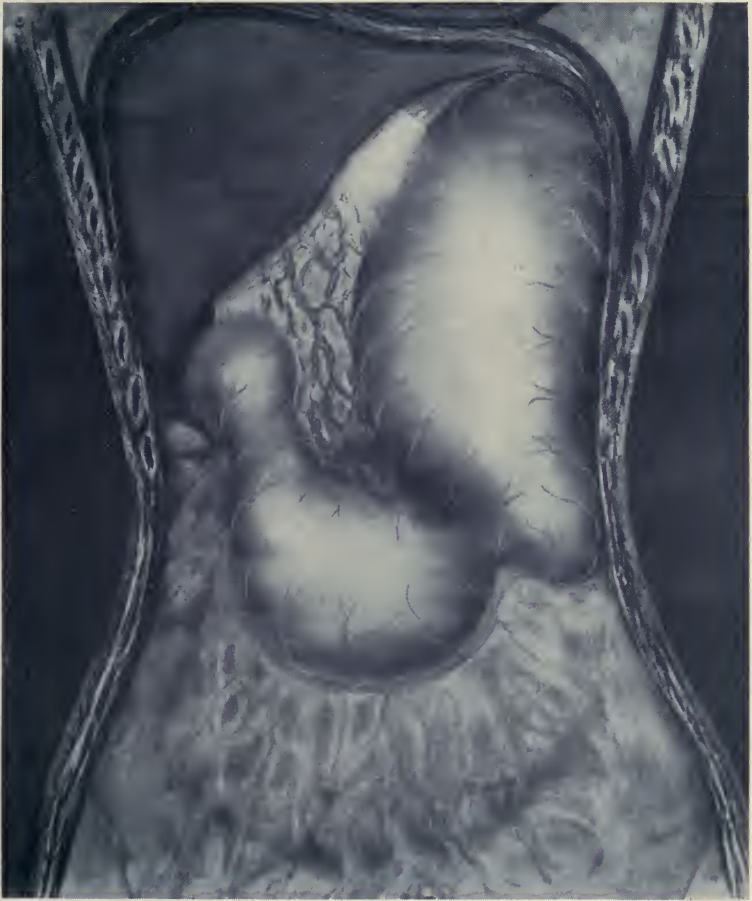
The fact that we find an ulcer or a resultant cicatrix is really no proof that the ulcer is primary, because the hour-glass stomach itself, on account of the hindrance of the passage and on account of the stagnation and decomposition of the contents of the stomach, is greatly disposed to the development of ulcerations.

Especially is there far more reason to believe that ulcer is secondary in the majority of cases where such ulcerations occur in the proximal part of the stomach. But in a great number of cases neither ulcer nor cicatrices occur!

There is, in addition, another fact, which is generally overlooked by most authors and which entirely precludes the correctness of the ulcer-theory. What I am aiming at is this, that, while *ulcus rotundum ventriculi* is equally frequent with males and females, the serious forms which ought to be demanded for the development of such thorough changes are even more frequent with men than with women, the hour-glass stomach being such a rare phenomenon with men that it must most appropriately be called a female disease. Here, so to say, the conditions quite resemble those of gastropptosis. It was just this which directed my thoughts toward the possibility of the solution of the enigma, which the pathogenesis of the hour-glass stomach presents, lying in gastropptosis.

The study of the clinical features and my operative experience have greatly strengthened this supposition. An investigation of the history of the disease as regards 26 cases of hour-glass stomach which I have personally observed shows that the first symptoms of the disease have always occurred during the years of puberty, when the subsequent, simultaneous misuse of the corset and the tight lacing commence. In their main features these symptoms entirely resemble those of virginal ptosis. Little by little the increasing hindrance of the passage, the retention, and the dilatation in the proximal part of the stomach are maintained as an aspect of the disease, and, if hæmatemesis and melæna occur in consequence of develop-

FIG. 1.



Hour-glass stomach, resulting from the folds growing together with their peritoneal surfaces.

FIG. 2.



Hour-glass stomach cut through.

ing ulcerations, the aspect becomes more and more that of ulcer stenosis.

By my numerous operations for gastropotosis I have been able to observe all the stages of the development of the hour-glass stomach, in consequence of which I have formed in my own mind a consecutive view of this.

With virginal gastropotosis the bends of the creases occur essentially and naturally in two places: (1) on the lesser curvature at the transition between pars cardiaca and corpus ventriculi in the very place where the triangular solid ligamentum gastrophrenicum (called by some pars condensamenti minoria) ceases and is relieved by the more elastic portion of omentum minus; (2) on the medial edge of ligamentum-hepaticoduodenale where the free portion of the duodenum (with the pylorus) bends toward the fixed part.

The hour-glass formation is generally due simply to the fine adhesions which form themselves in the folds of the serosa surfaces which rest one upon the other (see Figs. 1 and 2).

The development is sometimes greatly favored by this, that the omentum minus by coalescing with the omentum majus assumes a lace formation. With gastropotosis we very frequently find a complete loosening of the omentum minus, the central part of which subsides and hangs over the anterior side of the stomach like a tongue-shaped clump of the omentum. It may then come in contact with the tip of the omentum majus, and coalesce with this in a ribbon which draws a deep furrow in the stomach. The adhesion mentioned as occurring between the peritoneal surfaces, which I have seen in all stages, from those which commence extensively and are easily loosened to those which are hermetically soldered, fixes the ptosis creases, and these, like partition walls, protrude into the lumen of the stomach.

I have dwelt so explicitly on the aspect and pathological importance of virginal ptosis because it is still so unknown and so misunderstood, though it is now 14 years since I described it for the first time. Far better known is the other form.

2. THE MATERNAL GASTROCOLOPTOSIS.

This is the form we find with women whose abdominal wall consequent to past pregnancies and confinements has become distended, roomy, and relaxed. Hereby the intra-abdominal pressure is altered, and the support which the air-filled intestines offered to the subdiaphragmatic organs as long as the vigorous elastic abdominal wall acted fails.

With women whose stomachs lie in a normal and secure position at the moment when the relaxation of the abdominal wall commences, it depends entirely upon the strength of the ligaments whether a gastroptosis ensues at all. With strong women this does not occur; but with others, whose abdominal wall is less capable of resistance, a ptosis develops little by little; the development differing from the virginal ptosis in this, that the coloptosis is generally primary. The transverse colon, which is no longer borne up by the small intestine pelotte, is weighed down by the heavy fæces so that it hangs like a downward convex festoon suspended by the two flexures. The pull firstly affects the gastrocolic ligament and the mesocolon, which are elongated and dragged downward. It is quite common to find the gastrocolic ligament elongated to 3-4 times its normal length, when it is quite thin and perforated in many places. Secondly, it affects the stomach, the suspensory apparatus of which is also little by little stretched and elongated. The constipation and accumulation of fecal matter in the colon resulting from the coloptosis affects with steadily increasing strength the downward drag on the colon and the stomach. It frequently happens that the heavy, fæces-filled colon lies right at the bottom of the pelvis and, like an anchor, holds the stomach fixed in its subsided position. Furthermore, the stomach can drag down with it the lower part of the œsophagus, and then we encounter gastroptosis in its extreme form.

With maternal ptosis the aspect of the symptoms differs from that of virginal ptosis in this, that the stomachic attacks—cardialgia and vomiting—are far weaker, are often, indeed,

absent. It is due to the far more favorable conditions of space, as the stomach is not jammed or liable to be folded and bent as is the case with the virginal abdomen. For the same reason these patients do not generally suffer the innumerable pains and nervous sensations which characterize the others. That it is the distinction as regards space which causes the difference in the aspect of the disease is quite clearly perceived in the transition of a virginal ptosis to a maternal ptosis. So soon as the first confinement is overcome, a great improvement occurs in the condition of the patient so far as these symptoms are concerned.

With maternal ptosis, the constipation with all its consequences is the dominant feature in the aspect. In course of time the effect of the autointoxication from the intestine reveals itself. The patient grows emaciated and sallow, suffers from headache and, in addition, from an ever-increasing sensation of subsidence, and from the unpleasant, depressing feeling that something is subsiding in the abdomen, and from an oppressive sensation of and feeling of fatigue across the loins. The drag of the subsided stomach on the cardia and the œsophagus causes constant pain in the left side of the epigastrium and, not unfrequently, difficulty in the passing of the food through the œsophagus, so that a spasm of the cardia may arise—similar conditions sometimes occur with secondary dilatation of the œsophagus.

It is characteristic of the disease that all these symptoms improve or vanish entirely with confinement to bed, while they at once recur or become worse with an upright position.

The coprostasis may attain such stages that attacks resembling ileus may occur, and in extreme cases the stomach may also become so loose that *volvulus ventriculi* may occur.

II. TREATMENT.

When the surgeon has comprehended the correct nature of the disease, the question is whether the case lends itself to bandage-treatment or whether it demands an operative treatment.

As regards the indication for the employment of a bandage, this varies greatly with the two forms of ptosis which I have described. While the majority of the maternal ptosis patients may be helped sufficiently with a good and rational bandage, with virginal ptosis patients one only quite exceptionally obtains an effect worth mentioning. This simply lies in the fact that the virginal abdominal wall is so muscular, vigorous, and elastic that, to overcome its resistance, such a strong pressure would be necessary as would be unendurable to the patient. With maternal ptosis, on the other hand, we are able to obtain good results through the relaxed thin abdominal wall with a good bandage.

An effective and good belt must comply with three requirements: (1) The pressure must act widely over the hypogastrium by aid of a large and rather firm pelotte; (2) the pressure must be powerful and invariable; and (3) one must be able to adjust the belt in a recumbent position in the morning, before the patient rises and while the organs still lie in their right position. For this reason all bandages which fasten at the back with laces are banned.

After many experiments I have returned to a copious, firmly stuffed pelotte, placed on a steel-spring belt in which, as with the English double hernial truss, the pressure is exercised by two spiral springs which are movably connected with the large abdominal pelotte in front, and at the back are supported against the sacrum or against the sacro-iliac symphysis by one or two small pelottes (Figs. 3 and 4). These springs can be made as powerful as one wishes, and relax but slowly and slightly, when they are easily tightened again. But even this powerful belt, which I recommend as the best, is impotent with most virginal ptoses, as also with those particularly severe cases of maternal ptosis where the transverse colon has subsided right down into the small pelvis, and is on that account beyond the range of the belt, being squeezed rather than raised by this.

In all these cases, then, the only help for the patient is an operative encroachment which will raise the stomach and

FIG. 3.



Curtis's abdominal support, front view.

FIG. 4.



Curtis's abdominal support from behind.



colon into their normal position. For the achievement of this object we are in the possession of various methods: (1) direct gastropexy as it has been for the first time performed, independently of each other and after different methods, by Dupet and by Rovsing, and (2) the indirect operations which endeavor to raise the stomach, either by basting together and shortening the omentum minus as proposed by Stengel, Bier, and Beyea, or from below as with Coffey's operation which, by stitching the omentum majus firmly to the anterior abdominal wall, raises the stomach and colon.

If one were to choose *a priori* between these methods, the indirect operations would at first seem the more attractive, because with these one avoids fixing by adhesions an organ which needs mobility for its activity. Apart from the fact that adhesions in the peritoneum are for various reasons generally considered objectionable, one would think that a broad soldering of the anterior surface of the stomach to the abdominal wall must cause a considerable reduction of the motility and result in retention of the food, and it was just these objections and reasonings which led Beyea and Coffey to prefer the indirect operations. As the thought was also pleasing to me, I tried both methods, but have had to abandon them in favor of direct gastropexy.

Firstly, as regards Beyea's operation—the shortening of the omentum minus—this is in a great number of cases, and especially so in the severe cases which demand operations, technically impossible; because the omentum minus either no longer exists, or is so thin (as thin as tissue paper) and perforated that there can be no question of placing sutures in it. But even in those cases where the operation is possible, one generally gains only a temporary improvement or cure, because the same forces which have lengthened and weakened the ligaments continue to act, and by degrees the ligaments will again give way and the stomach will subside.

Coffey's operation seems to be more rational and better devised, because in many cases the omentum majus is strong and well preserved, and because, owing to its being fastened

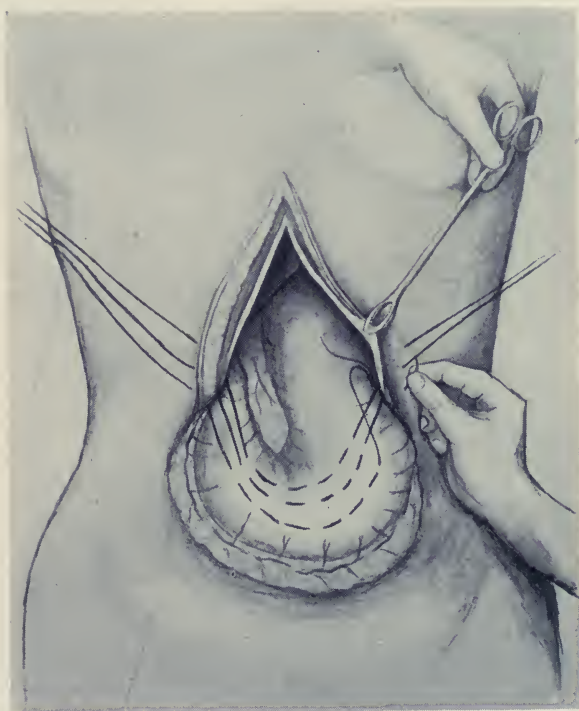
to the anterior abdominal wall, a raising of the greater curvature as well as of the transverse colon takes place and, in addition, a stretching of the mesocolon transversum on which the stomach normally rests. In Coffey's hands this operation seems also to have given fine results.

In the cases where I have attempted this operation, it has answered most satisfactorily during the period immediately following it, but in the course of a few months the patients have returned, suffering in part from the old symptoms and in part from new ones arising from omental adhesions (pains, constipation, diarrhoea). The reasons for this are: first, that the omentum can be fastened to the sides of the centre line only in an inferior degree, and that for this reason there is room for a subsidence of the fundus of the stomach in the left side, and then a bend between the free part and the fixed part easily occurs; second, that the omentum is very slack, and its adhesions therefore easily drawn out into long bands which present the danger of ileus.

Notwithstanding the theoretical attraction of the indirect operations, I must in accordance with my experience advise direct gastropexy as the safest and best method.

When, in 1897, I thought for the first time of performing gastropexy with a patient who was admitted with the diagnosis of cancer of the stomach, but who only showed gastroptosis pure and simple, it appeared from an inspection of the literature that such an operation had been performed once before by Duret, of Lille, in accordance with the method here portrayed: He made an incision through the skin and the muscles to the umbilicus from the ensiform process, but incised the peritoneum only in the lowest half of the wound, and then fixed the lesser curvature of the stomach to the untouched upper part of the parietal peritoneum with the aid of a single silk thread. This was led in and out alternately through the serosa of the stomach and the parietal peritoneum. The ends of the thread were conducted out through the recti muscles, and were tied subcutaneously over these. The method did not meet with my entire approval; first, because a single thin silk thread seemed to me too insecure a fastening, and

FIG. 5.



Author's method of gastropexy.

FIG. 6.



Author's method of gastropexy. The silk sutures are held over a glass plate.

in the next place because I found it precarious to fix the pylorus, which normally should lie deep down and be mobile, to the anterior abdominal wall, and finally because the tying of the silk threads in the centre line must inevitably involve a serious shrinkage and folding of the lesser curvature. In that first case I at once employed the method which I firmly recommend as being the best: Parallel with the lesser curvature I lead three strong silk threads in and out through the serous coating of the anterior surface of the stomach, leaving the pyloric portion free. The upper thread is placed close under the lesser curvature, and the two others, with an interval of about 2 cm., are placed in such a way that the greater curvature and a rather large piece of the wall above this are left free (Fig. 5). With a fine needle the serosa coating between the threads is now scarified in all directions, also the surface of the parietal peritoneum, and eventually that part of the under side of the liver to which one wishes the stomach to adhere. The ends of the silk threads are led out through the entire thickness of the abdominal wall, that on the left as far as the side of the rib-curve, and that on the right at about 3 cm. to the right of the centre line. The peritoneum is now joined with catgut, and the fascia and skin with aluminum bronze, and, after the line of wound has been covered with collodion and cotton wool, the silk sutures are tied over a glass plate covered in sterile gauze (Fig. 6), the dimensions of which are a little larger than the stomach surface which has to be fixed. In this way it follows that the anterior surface of the stomach lies flat and close to the abdominal wall, without shrinkage and folding. These threads are left for four weeks and are then easily removed. A perfectly secure and solid adhesion is thus obtained.

After having employed this method with excellent results in 90 cases I allowed myself, in 1907, to be induced by Cannon's investigation as to the importance of the prepyloric part of the stomach with regard to the mechanical manipulation of food to modify my operation in such a way that I left the entire prepyloric part free, and only fixed the fundus with the aid of three silk threads, which passed transversely over the axis of the stomach and which were tied over a glass plate to the left of the centre line. With the systematic after-examination of all the cases treated with gastropexy up to January 1, 1911, the results from the latter method have proved to be far inferior to those of the

former, because while the former gave 60 complete cures in 94 cases, the latter gave only 29 cures in 69 cases. For this reason I have returned to the former method, and have employed it with my last 30 cases, the results so far being excellent.

Since 1897, when I performed my first gastropexy, till January 1, 1911, I have myself performed the operation 163 times, and have received information from other Scandinavian surgeons of 93 operations performed in accordance with my method. All these 256 patients have been traced and their condition since the operation carefully examined, with the following result:

ANALYSIS OF RESULTS OBTAINED IN 256 GASTROPEXIES.

	Per cent.
Complete cure.....	162 = 63.2
Great improvement.....	33 = 12.8
Improvement.....	18 = 7
Slight improvement or no change.....	32 = 12.8
Deaths.....	11 = 4.6

On separating my own statistics of 163 cases I get:

	Personal statistics. Per cent.	Statistics of Scandinavian surgeons. Per cent.
Cure.....	92 = 50.6	70 = 75.2
Great improvement.....	24 = 14.7	9 = 9.6
Improvement.....	18 = 11	
Slight improvement or none.....	21 = 12.8	11 = 11.8
Deaths.....	8 = 4.9	3 = 3.2
Total.....	163	93

First, as regards the mortality, it may well be said that a mortality of 4.6 per cent. is *per se* small. But on analyzing the cause of death in the individual cases the real mortality from gastropexy proves to be far smaller.

As concerns my own patients, two died a fairly long time after the operation from tuberculosis of the lungs, while four extremely exhausted patients died from bronchopneumonia during the week following the operation, but without any morbidity at all in the peritoneum.

On the other hand two died from ileus; the one from

a duodenoventricular ileus due to the strangulation of the duodenum over an old adhesion, the other from ileus of the small intestine due to an accidental strangulation of a coil of the bowels over an old adhesion due to an old hysteropexy.

As regards the three deaths mentioned in the statistics of the other Scandinavian surgeons, two of them had absolutely nothing to do with gastropexy as such: the one was due to a casual perforative appendicitis, the other to bleeding from a gastro-enterostomy performed simultaneously with gastropexy. In the third case, however, death must be ascribed to gastropexy, inasmuch as it was due to ileus of the stomach, the result of the hepatopexy having been neglected; the sunken liver then rode over the pyloric part of the fixed stomach.

The mortality with gastropexy proper is then 3 in 256 or 1.17 per cent.

As regards the recoveries, 71 or 75 per cent. of the patients were cured to the extent of being relieved of their pains, of regaining a healthy appearance and their strength, and, from being incapable, depressed, miserable wrecks, of becoming able-bodied, healthy, and happy people.

I wish to draw special attention to this, that *gastropexy in 76 of my 163 cases has freed the patients of their constipation of many years' standing, which had proved intractable to any other treatment.*

All these cases were equally severe, and some were more serious than those for which Arbuthnot Lane advised extirpation of the colon or ileosigmoideostomy: operations the dangers of which are extremely great as compared with those of gastropexy.

There then remain about 25 per cent. of the cases where the effect of the operation has not been satisfactory: in 11 per cent. the condition was improved considerably, but in 12.8 per cent. the improvement was quite insignificant or nil. As regards the cause of the bad results, an analysis of these cases warrants the hope that still better results may be attained in the future.

Here I shall first point to the circumstance that during a

period which comprises 73 cases, I employed, from fear of fixing the prepyloric portion, a method which a revision of the results has proved to be greatly inferior to my original method, inasmuch as the cures were 20 per cent. less in number. It is obvious that a future systematic carrying out of the original method of operation by a broad joining of the stomach to the abdominal wall will improve the results considerably. On other points, also, a change in the method of operation will effect improvement in the results.

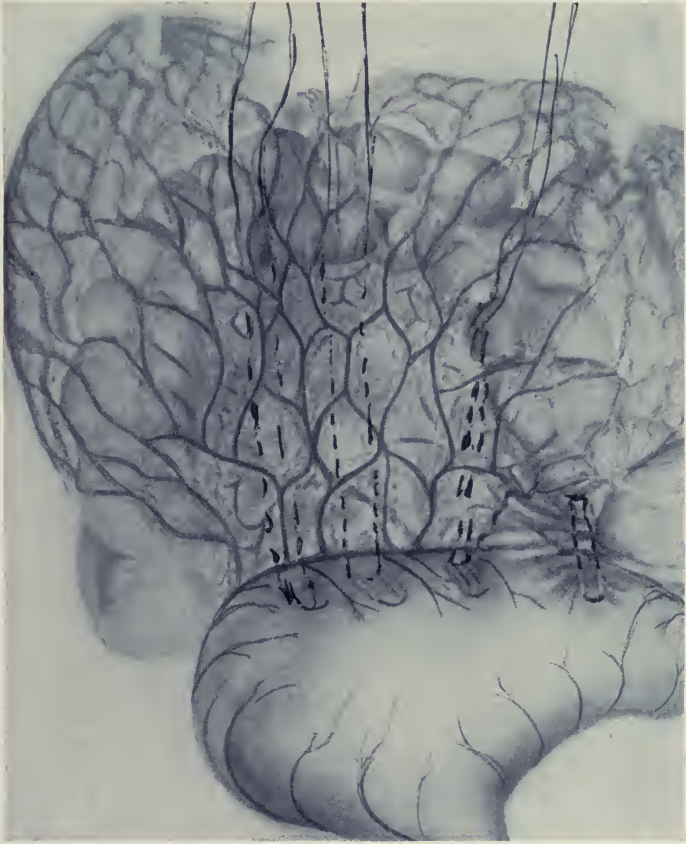
In all cases where the gastrocolic ligament is considerably elongated, one does not obtain by gastropexy pure and simple a lifting of the colon sufficient to remove the constipation.

In order to obtain this a special operation is required, and some of my less successful cases in earlier days are surely due to my non-appreciation of this and to later experiments with various inferior methods. Here, the right operation has proved to be the *shortening of the omentum and the mesocolon* by basting this with the aid of a row of thick catgut threads, which commence in the serous coating of the colon and end at the greater curvature (see Fig. 7). For me this has proved to be the ideal method as against the colopexy and the omentopexy to the anterior abdominal wall; because, while these restrict the mobility of the large intestine and in addition often cause adhesions, the shortening of the mesocolon and the omentum raises the intestine without restricting its mobility. The result seems to be permanent. A systematic employment of this little operation as an accessory to gastropexy in all cases with an elongated gastrocolic will increase the number of the entirely cured.

In some cases an imperfect diagnosis has been the cause of the bad result, as, for instance, the overlooking of an ulcer in the stomach or in the duodenum or of cancer in another organ. The improved diagnostic methods, and especially gastroduodenoscopy, will probably decrease the number of such mistakes in the future.

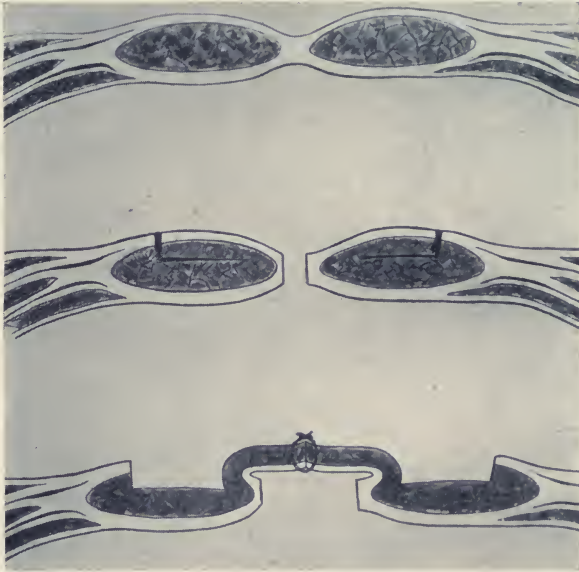
Finally there is a very important point which explains the difficulty of obtaining in many cases a complete cure for

FIG. 7.



Author's method of shortening the gastrocolic ligament.

FIG. 8.



Author's method to enlarge the abdominal wall in cases of vaginal ptosis.

these patients, viz., the many consequences of enteroptosis and lacing which are co-ordinate with gastro- and coloptosis. First, the straitening of the lowest aperture of the thorax may be so considerable that there is no longer any room at all for the liver and the stomach, and therefore it is impossible to fix the stomach in a satisfactory manner without jamming it, just as it is impossible to get the colon sufficiently raised and to straighten out its folds and bends.

Even if the condition of the patient improves somewhat, the pains and the constipation in particular will nevertheless continue after the gastropexy.

Where the stomach is concerned, I think that one may obtain better conditions: partly by giving up any idea of its reposition, inasmuch as one fixes it lower down where there is room for it, and partly by making the abdominal cavity more capacious with a plastic enlargement of the abdominal wall. In no insignificant number of cases of gastropoptosis one finds the space above the umbilicus so contracted that one has the greatest difficulty in inserting a finger between the vertebral column and muscoli recti; if one fixes the stomach up here where it ought normally to lie it is jammed.

In such cases I have attained an excellent result by doubling the width of muscoli recti in the following manner. Of the anterior blade of the rectus sheath and the anterior muscular layers I have formed rectangular lobes with their base at the medial edge, which lobes I have then joined in the centre line (Fig. 8).

If it is difficult in such cases—which always belong to the virginal type—to make room for the stomach, it is generally impossible to do so where the colon is concerned. Here the bends at the flexura become sharper and sharper, and become fixed by adhesions between the serosa surfaces at the angles. The constipation becomes more and more obstinate and invincible, and the autointoxication and pains render these patients utterly miserable.

Here, in this fortunately small group of cases, is, according to my experience, the real indication for Arbuthnot Lane's

“shortening” by ileosigmoidostomy, which I have employed with excellent result in two otherwise quite desperate cases. It was most interesting to notice how the abhorrence of food and the malaise of many years’ standing of these patients were succeeded by a ravenous, almost immoderate appetite. With one of these patients the purgation showed a tendency to turn into diarrhœa, which, however, I was able to keep in check by dieting.

What still has great influence on the results of gastropexy is the ptosis of other abdominal organs, above all of the liver and the kidneys which is so frequently present.

That a considerable hepatoptosis prevents a good result from gastropexy is evident, because, when the patients get up after the operation, the liver falls and lies across the stomach and its supports, which may not only cause pains, but may also cause ileus of the stomach, as was the case with one of the deaths reported by Hertel.

Therefore, with attendant hepatoptosis, hepatopexy should always be performed simultaneously with gastropexy. How frequently this is indicated is seen by my having had to perform hepatopexy in no less than 68 of my cases. I perform this in part directly with silk sutures which fasten the serosa covering on the convexity of the liver to the diaphragm, and in part indirectly with the aid of the ligamentum teres. This is severed after a double ligature, and the topmost end sewn to the diaphragm with strong silk thread, whereby the liver is raised up. It is of great importance that hepatopexy shall be performed very substantially with wide scarifications, in order that the heavy organ shall not tear itself loose again, and sink down on the stomach.

Sometimes the lacing involves the development of a large hypertrophied left lobe of the liver, which pushes against the curvature minor, and thus makes impossible the replacement of the stomach in its normal position.

In four cases I have been obliged to remove such a lobe of the liver by resection, in order to be able to perform gastropexy.

I perform the resection without loss of blood by simply pinching in two the liver tissue at the base of the lobe with Roux's angiotribe. Only the peritoneum holds, while the liver tissue bursts, and the vessels of the latter do not bleed. The large vessels are seen projecting from the surface and can easily be tied for the sake of safety. The peritoneum is then joined across the broken surface of the liver. If the peritoneum should burst or be insufficient for the covering of the surface of the wound, I transplant a piece of the omentum for the purpose.

In some few cases where pains and constipation remain after gastropexy, this is due to the prolapse of one or both kidneys, and the patients do not then recover entirely until after a nephropexy. With 10 of my cases it is not until after a unilateral or a bilateral nephropexy that I have succeeded in attaining an absolute result. A right-sided nephroptosis, especially, often involves a prolapse of the ascending colon and a pressure on the cæcum, thereby keeping up the constipation and pains.

In certain quarters there has arisen an inclination to maintain that the only operation which could be indicated with gastroptosis is gastro-enterostomy, because the vomitings and pains must be due to difficulty in the passing of food, "atony" and dilatation of the stomach. Now it is quite correct that, in a certain number—about 50–60 per cent.—of gastroptosis cases which require treatment, a slight delay in the emptying of the stomach occurs, so that this is completely emptied only after 5–6 hours. This delay is, however, by no means due to "atony," the muscular organs of the stomach really being in perfect order and prepared to act so soon as the stasis in the bowels, which is due to the constipation and to the ptosis bends on the large and small intestines, is removed.

Therefore gastro-enterostomy is never indicated with a simple gastroptosis, experience even showing indeed that it is a highly injurious operation, inasmuch as not only do the existing symptoms deteriorate greatly but an entirely new complex of symptoms also supervenes: nausea and gall-

vomitings. This is simply due to the fact that gastro-enterostomy does not at all strike at the cause of the stasis, which lies in the large intestine and far down in the small intestine at the opening into the cæcum, but, on the contrary, instead of removing the drag and the weight which the subsided stomach exercises, only increases this further, and a bend will very easily arise on the subsided folded coil of the anastomosis, which leads to a more or less pronounced circulus vitiosus.

Gastro-enterostomy, then, only increases greatly the sufferings of the ptosis patients, and even reduces them to a condition of extreme emaciation and misery. At one time or another I have had eight such patients under treatment. With four of these I have obtained a complete cure and with the other four a very great improvement by separating the intestine and the stomach at the point of the anastomosis, and, after having individually closed these, by performing gastropexy.

Therefore it is of extreme importance distinctly to diagnose between ulcer and gastropptosis. Because, excellent as the effect of gastro-enterostomy is with ulcer stenosis of the pylorus, just as injurious it is with a simple ptosis. Even if there is ulcer with ptosis without stricture of the pylorus, my advice, in accordance with my own sad experience, is entirely opposed to gastro-enterostomy. If the ulcer is small, and situated on a ptosis fold, one has to be content with a simple gastropexy, which then generally leads to the ulcer being healed. If the ulcer is large and infiltrating, it should be removed by excision.

I have chosen to discuss in this paper the pathological importance and treatment of gastrocoloptosis because, although it is extremely common the world over, and in spite of its turning a very large number of individuals, females in particular, into disabled, tortured, pitiable invalids, it is still greatly misunderstood and incorrectly treated.

It is of importance to surgeons to know that the disease is in a number of cases confounded with ulcer ventriculi and

cancer ventriculi, in order that they neither perform a useless, often injurious, gastro-enterostomy or close the incision, disappointed at not finding the anticipated ulcer or cancer, but perform the simple encroachment of gastropexy which alone can cure these patients.

It is of far greater importance to draw attention to the fact that the majority of these cases do not reach the surgeon, because the doctors, confounding cause with effect, enroll them under hysteria and neurasthenia, because they consider the stomachic and intestinal symptoms to be the outcome of a nervous, degenerative disposition; while, in reality, all the nervous symptoms are a result of ptosis and constipation. These patients wander in vain from doctor to doctor and from treatment to treatment, without finding relief. Small wonder that they become more and more nervous, and finally give one the impression of being above all neuropathic individuals.

If physicians the world over could have their eyes opened to the right diagnosis and treatment of these symptoms, an extraordinarily large number of suffering, disabled persons might regain health and strength by a bandage-treatment or by gastropexy, and the physicians would be relieved of the most ungrateful and wearisome patients.

A NEW PRINCIPLE IN ŒSOPHAGOSCOPY AND GASTROSCOPY.

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A VAST literature has accumulated on the subject of œsophagoscopy and an enormous amount of energy has been expended in the last two decades in the construction of new œsophagoscopes. In spite of these facts it must appear obvious to one who has investigated the matter that œsophagoscopy has as yet not received recognition as one of our safe and reliable diagnostic methods. There is no question that in a large proportion of œsophageal affections, as for instance strictures, neoplasms, foreign bodies, etc., a visual inspection is of the greatest advantage to the patient as far as the diagnosis and therapy are concerned. Let me remind you of the unexpected results that have followed the introduction of the cystoscope into urology. Is it not surprising that œsophagoscopy should have been so slighted by comparison, notwithstanding the fact that there has been no lack of effort in this direction and that the first attempts to inspect the œsophagus date as far back as those to inspect the bladder?

We can only explain this disproportion by the fact that as yet it has been impossible to construct an œsophagoscope that can be used with the same safety and reliability as the cystoscope. It is not that there is no demand for such an instrument. At first many were disposed to reject the cystoscope, and yet after a short time cystoscopy was generally adopted.

The great number of instruments heretofore constructed fall into two distinct groups: (1) straight tubes, which are introduced with the head in hyperextension; (2) jointed tubes, which are only straightened after their introduction into the

œsophagus. For the sake of brevity I shall only refer here to the two main types of œsophagoscopes that have been used up to date. Whoever wishes more detailed information is referred to the exhaustive historical review of the subject in Starck's "Die direkte Besichtigung der Speiseroehre. Œsophagoscopie," Würzburg, 1905.

The main exponent of the straight tube was v. Mikulicz, who began his researches as long as thirty years ago. The construction of these tubes is extremely simple, irrespective of whether the light is thrown in from without (v. Mikulicz), or whether the illumination is placed at the distal end of the tube (Jackson). Obviously, difficulties in construction cannot be held responsible for the fact that these instruments are not in general use. As an example that these instruments, in spite of their simplicity, are still unpopular, let me call your attention to the fact that the large majority of surgeons even to-day prefer to remove a foreign body by means of an external œsophagotomy instead of via the œsophagoscope. This proves rather conclusively that the introduction of these instruments is associated with the greatest discomfort, nay even danger, to the patient. The instruments of this type do not take into consideration the normal rectangular formation existing between the oral cavity and the œsophagus, which is only partly obliterated by hyperextension of the head. The introduction is frequently very difficult even when the teeth are missing, and when they are well preserved it is often impossible. Thus, some authors even go so far as to recommend the extraction of one or more teeth to make the introduction possible! I, personally, had the opportunity of examining an œsophagoscope which had been introduced by one of my colleagues and which distinctly showed the dental impressions in the hard steel. It is small wonder that patients will not tolerate such discomforts—to put it mildly.

So much for the discomforts. What, then, are the dangers of the straight tubes? It is well known that their use has been followed by a large proportion of perforations of the œsophagus, which resulted fatally. One of the reasons for this is that

the tube cannot be inserted in the longitudinal axis of the œsophagus even if the head is in extreme extension. There always exists a more or less obtuse angle between the tube and the œsophagus, and thus it is easily possible, especially when a certain amount of force is used, to crush the œsophagus against the spinal column and perforate it (Fig. 1).

The same danger exists with the second type, the jointed tube. This tube is constructed of a number of hinged joints, which after their introduction either snap into place automatically, or by means of a wire are pulled straight. In spite of the fact that it is not necessary to hyperextend the head with this instrument, its introduction is by no means easy and devoid of danger. Here also an angle is formed between instrument and œsophagus which makes its introduction difficult. Another difficulty is offered, which the accompanying diagram (Fig. 2) clearly illustrates. When one tries to introduce the instrument into the deeper parts of the œsophagus, one meets with considerable difficulty as soon as the instrument strikes the posterior wall of that organ and impinges on the spinal column. The instrument will no longer glide downward in direction of the arrow *c*, but points *a* and *b* will simply be approximated and the curve of the instrument increased, while the instrument sticks fast. These are not merely theoretical considerations, for in the beginning of my studies I experimented for several months with various tubes which I constructed upon this principle.

On the basis of these observations and experiences we must conclude that a satisfactory œsophagoscope must fulfil the following three main requirements:

1. The introduction must be possible in the normal position of the head.
2. The instrument must be so constructed that it actually passes in the longitudinal axis of the œsophagus and not at an angle to this axis.
3. The œsophagoscope should only be passed downward along the œsophagus under guidance of the eye to avoid perforations.

FIG. 1.

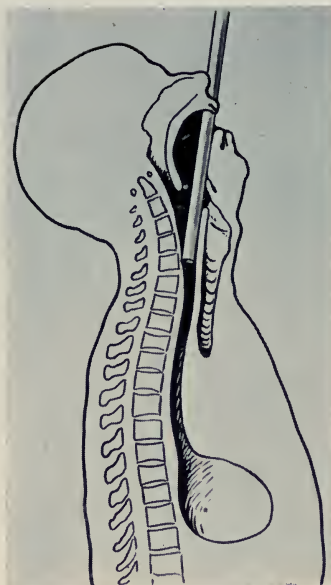


Diagram showing disadvantages and dangers of the straight tube.

FIG. 2.

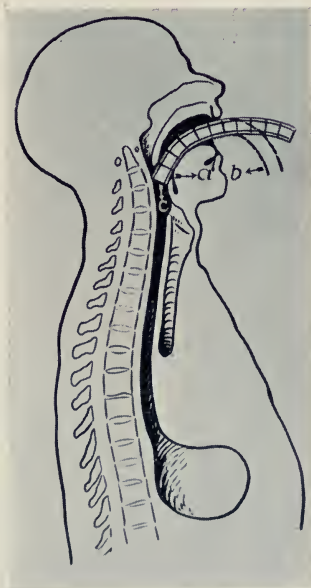
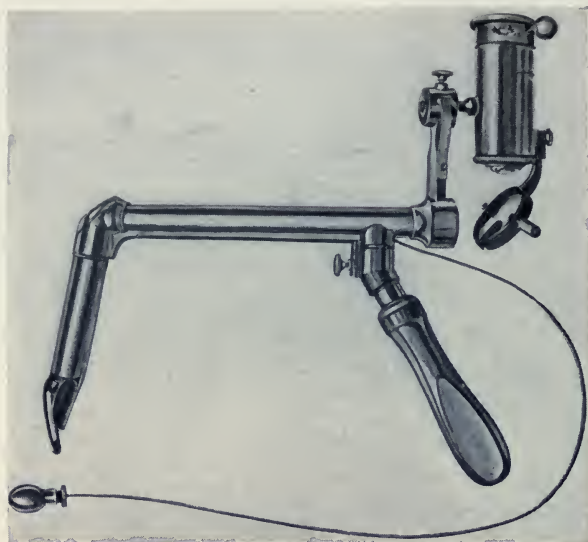


Diagram showing difficulty in introducing jointed tube.

FIG. 3.



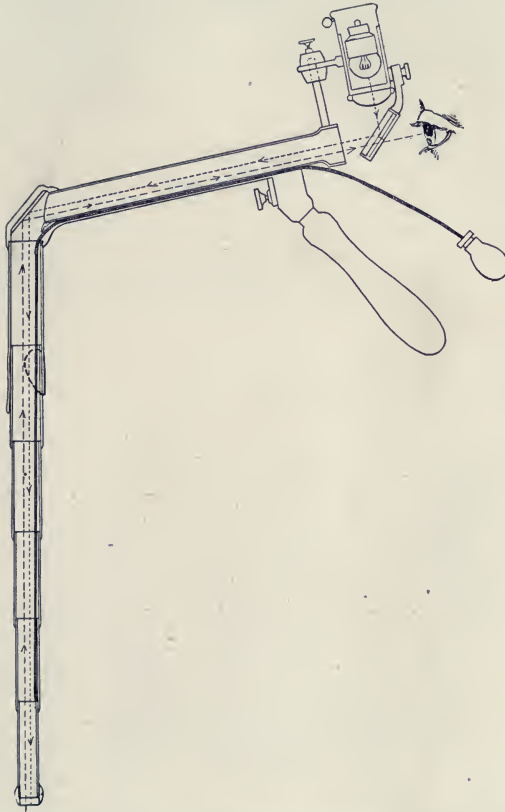
Rectangular telescopic oesophagoscope (telescope closed).

FIG. 4.



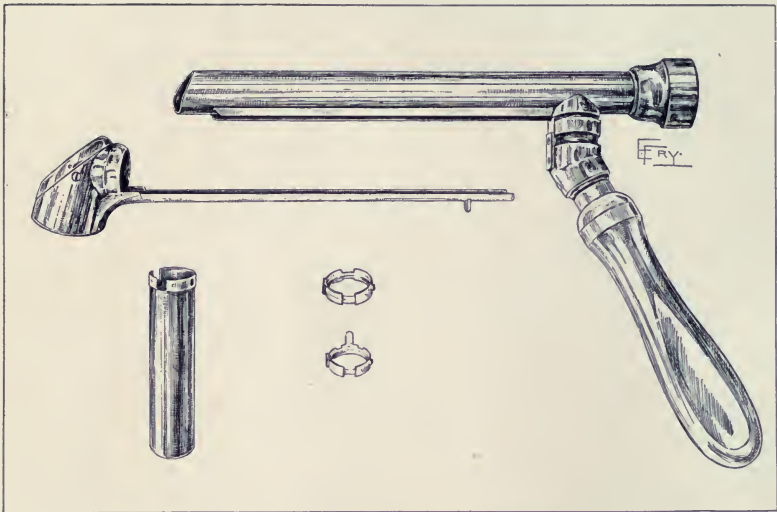
Rectangular telescopic oesophagoscope (telescope opened).

FIG. 5.



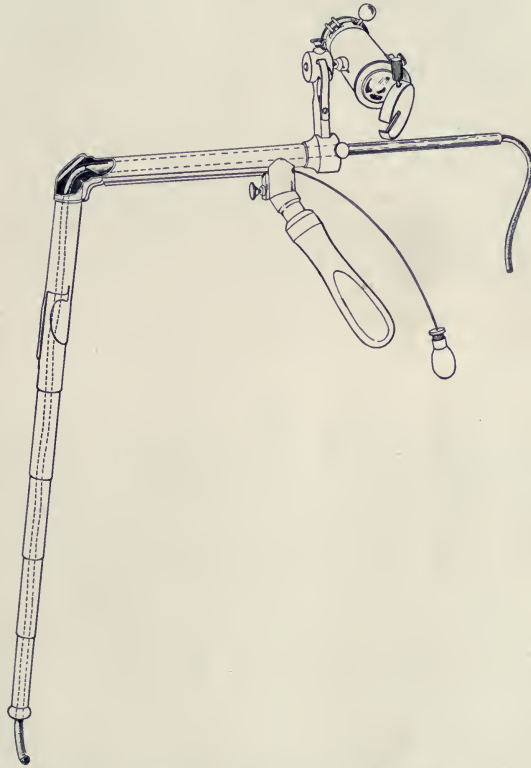
Diagrammatic sketch of the cesophagoscope, showing the directions of the rays of light.

FIG. 6.



Sketch of separate parts of the œsophagoscope.

FIG. 7.



Sketch of cesophagoscope with aspirator in place.

FIG. 8.



Introduction of œsophagoscope (first stage).

FIG. 9.



Œsophagoscope in position.

FIG. 10.

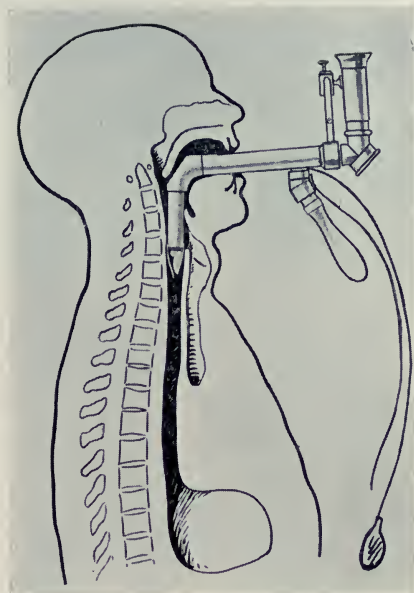


Diagram showing œsophagoscope in position with telescope closed.

FIG. 11.

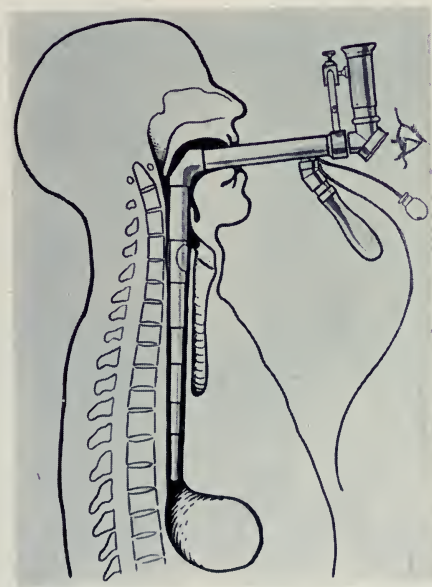
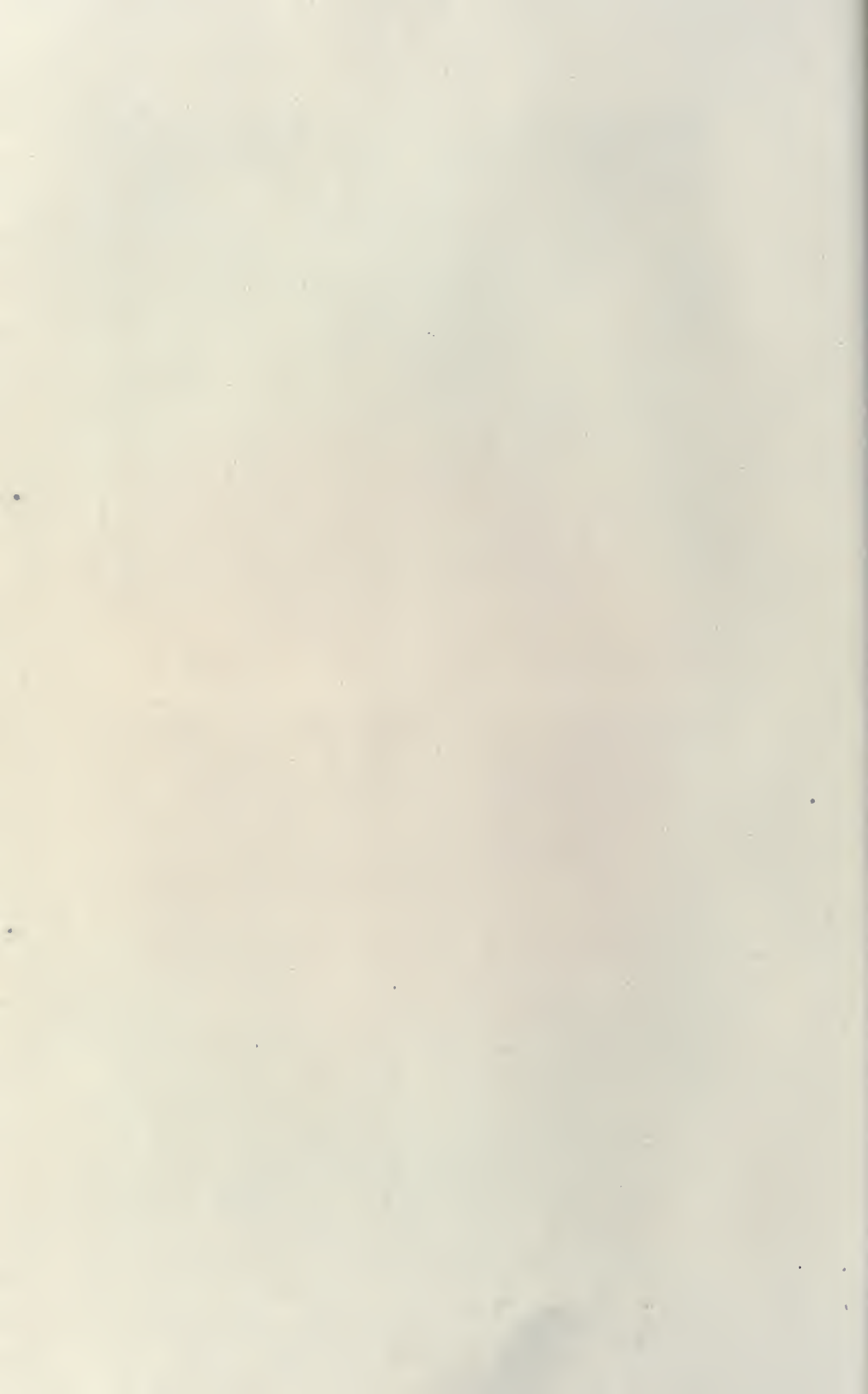


Diagram showing œsophagoscope in position with telescope opened.





1



2



3



4



5



6



7



8



Based upon these three main considerations I have constructed an instrument in the following manner:

The instrument consists of two portions which are joined together at almost a right angle; first, the horizontal portion which lies in the mouth of the patient during the examination, and second, the vertical portion consisting of a telescope composed of six separate tubes which may be pushed down into the œsophagus as far as necessary (Figs. 3 and 4). The horizontal portion consists of two parts which are represented in Fig. 6. These two parts can easily be separated by traction in a horizontal direction. These two parts each carry a semicylindrical canal. When the two parts are combined, the canals form a tube. In this tube the spring, which is necessary for the manipulation of the telescope, rests. In this way this spring lies entirely outside of the main horizontal tube and does not disturb in any way the passage of the light rays.

At the proximal end of the horizontal tube, which, of course, lies outside of the mouth, is attached the illuminating apparatus. This consists of a lamp and condenser (Fig. 5). I use a Tungsten lamp containing three crossed filaments. This lamp is copied from the one constructed by Fischer of Freiburg, but it gives a much more intense light. An exceptionally strong source of light is necessary for my instrument, because, as can be seen from Fig. 5, the light is broken three times before it reaches the eye of the observer. Naturally, therefore, much more light is lost than with the straight œsophagoscope where the ray is not interrupted at all or, at most, once. The street current is adopted for the light by means of a rheostat. Inasmuch as the lamp is well insulated, one need not fear a short circuit. Directly under the lamp a condenser is placed which concentrates the rays. The rays then fall on a mirror (Figs. 3 and 5) which is movable on a horizontal axis. From this mirror they are thrown to a second mirror which lies at the junction of the horizontal and vertical portions of the instrument. This second mirror interrupts the rays in such a fashion that they fall directly downward in the telescope. The return of the rays to the eye of the observer is clearly shown in Fig. 5. The picture is inverted but not reversed.

I use the thinnest possible quartz mirror. As a result of the thinness, the loss of light on account of penetration of the glass is minimal and a quartz mirror polarizes light much less than the ordinary mirror, which fact also adds to the brilliancy of the light. The distal mirror is easily removable, so that it can be cleaned. The vertical part of the telescope is attached by means of a thread to the horizontal portion. To separate the telescope from the horizontal part of the instrument, it is first necessary to unscrew the olive at the end of the spring and to detach the screw lock that holds the two separate portions of the horizontal part together. The horizontal tube is then pulled out (Fig. 6) and the carrier of the distal mirror is then unscrewed from the telescope by means of a key. The part holding this mirror is then lifted off and nothing but the telescope with the spring attached remains.

In describing the telescope which is the essential novelty of this instrument, I wish to limit myself to the main points in its construction. It would be impossible to go into all the details of construction, as it would make the description too complicated. The telescope consists of six steel tubes, the walls of which are 0.8 mm. thick. At the upper and lower end of each tube is an attachment, of which the upper is shown in Fig. 6. The inner attachment protrudes into the lumen of the tube and forms a ridge, on which the next tube catches, when the telescope is open.

As can be seen in Fig. 6, the upper attachment of the tube is more than a simple ridge and is so constructed that a ring can be inserted into it. The rings serve the same purpose as the cylinder under the horizontal tube, namely, to keep the spring entirely out of the field of vision. They can be easily inserted into the upper part of each tube and just as easily removed with a small lever. On the outer part of each ring (Fig. 6) is a small plate and a button which fit into corresponding openings in the attachment to the tube and which keep the rings in place. On the posterior part of the ring (shown anteriorly in Fig. 6) is a groove which permits the spring to pass between the ring and the telescope.

Opposite this groove for the long spring is a small spring attached to three of the six rings. This small spring glides along the inner wall of the telescope when it is opened, and when the telescope is closed fits into a small groove in the ring just above and is thus buried. Although these little springs seem quite insignificant, they are of the greatest importance for the proper functioning of the telescope. The long spring (Fig. 5) has a tendency to produce a slight curvature of the telescope with the concavity toward the observer. That the telescope may work surely, especially for its withdrawal, it is essential that it is perfectly straight. This is the function of these short springs, namely, to counteract the tendency toward curvature produced by the long spring and to insure an absolutely straight telescope.

The distal end of the spring is soldered with silver to the upper edge of the lowest tube. At the lower end of the innermost tube is a metal ring which can be unscrewed and which opens the lumen of the œsophagus when the telescope is pushed down. This ring also facilitates the downward passage of the telescope. Attached to the lower part of the upper tube are two metal guides (Fig. 3). These guides are not only attached to this tube, but the tube and guides are made of one piece of metal. I shall later refer to the importance of these guides for the introduction of the œsophagoscope. These guides greatly facilitate the introduction of the instrument and since I have used them I have never had the slightest difficulty in introducing the œsophagoscope, with the exception of one instance, where pathological changes were responsible. The length of the telescope is now 33 cm. If one adds 10 to 12 cm. as the distance from the posterior pharyngeal wall to the teeth, then the total distance from the teeth to the end of the instrument is 45 cm., which is quite sufficient to inspect the entire œsophagus down to the cardia. The diameter of the six tubes of the telescope varies from 12 mm. (lowest tube) to 17 mm. (uppermost tube). It would be easily possible to add another tube

above with a diameter of 18 mm. There is sufficient room in the œsophagus to do this. This would add another 5 cm. to the telescope and it would be possible in a suitable case to even pass the instrument into the stomach and thus to attempt a direct gastroscopy. From its point of emergence from the horizontal portion of the instrument (Fig. 3) the spring is marked at intervals of 5 cm., so that one can easily tell how far the telescope has been passed into the œsophagus.

In order to clean the telescope, I advise its complete separation into its individual portions, a thorough cleansing of each part with benzine, sterilization by boiling, and lubricating with vaseline before reassembling the parts.

Without going too much into detail I might mention here that it is possible in examining high lesions in the œsophagus that one may not need to use all six tubes. One might reduce the thickness of the instrument and at the same time increase the field of vision, if one had three sets of tubes to be used according to the height of the lesion. The following combinations would be practicable: 1, tubes 1-6 inclusive; 2, tubes 2-5 inclusive; 3, tubes 3 and 4.

On account of the right angular construction of the instrument and the rings which protrude into its lumen, it became necessary to construct an aspirator which differed somewhat from the one in ordinary use (Fig. 7). The rubber tube is carried over the right angle by means of a spring resembling the Albarran finger of the cystoscope which is attached to a metal tube through which the rubber tube is passed. That the rubber tube does not catch on the rings, a small perforated metal button is attached to its distal end. The outer end of the rubber tube is attached to an aspirating bottle. With this instrument the aspiration of mucus is as easy and certain as with the straight tube.

I shall not say much here about the forceps which I am now constructing. Certain changes are necessary for it to compete in usefulness with the forceps that is used with the straight tube. I am convinced from my previous experiments in this direction that this problem will soon be solved. I hope to be able to present this forceps in a later publication, and also to describe a bougie that can be used with my instrument.

The method of examining the patient with my new instrument is as follows: The patient sits on a chair, the head being supported by an assistant. The pharynx is anæsthetized with a 10 per cent. or 20 per cent. solution of cocaine. The introduction of the œsophagoscope is accomplished in two stages:

1. *The "anchoring" of the instrument in the œsophagus:*

The examiner stands in front of the patient, and while he draws the tongue out lightly with the left hand, pushes the instrument with the right hand to the posterior wall of the pharynx (Fig. 8), keeping the instrument exactly in the

middle line of the head. When the distal extremity of the instrument touches the posterior pharyngeal wall, the handle must be gently elevated, until the ocular comes into a horizontal plane. In this way the instrument glides automatically over the epiglottis and arytenoid cartilages, and the two metal guides at the distal end of the upper segment of the telescopic tube anchor themselves in what Killian has termed the "mouth of the œsophagus." If the spring is then pushed forward a few centimetres, the metal guides are separated and the œsophagus opened, the innermost of the six telescopic tubes passing the guides and exposing the œsophagus to the visual field.

2. The passage of the œsophagoscope into the deeper parts of the œsophagus:

Although the anchoring of the instrument in the mouth of the œsophagus is performed blindly, this second stage of the process must only be undertaken under the guidance of the eye. The examiner seats himself on a chair in front of the patient and then pushes down the spring (Fig. 9), while watching the descent, as the patient swallows.² It is essential that the lumen of the œsophagus is always kept in the field of vision. Usually this is easily accomplished. Should it vanish or become too excentric, it can be easily brought into view by gently lifting or dropping the handle of the instrument. When the examination is finished, the spring is gently pulled until the telescope is again closed (Figs. 10 and 11). The instrument is then withdrawn by dropping the handle and lifting the closed telescope out of the mouth.

The advantages of this right-angular telescope, as compared with the straight tube, are very marked. It is immaterial whether the patient has an easily movable cervical spine or a full set of teeth or not. The patient is not brought into any strained position, and the head is held in a natural way during the entire examination. The finding of the entrance of the œsophagus, which is often exceedingly difficult for the inexperienced beginner, occurs here blindly and automatically. The two metal guides act as an obturator or a sound, and lead the way for the instrument. The opening of the telescope is

so simple, because this instrument is the first that can really be pushed down in the longitudinal axis of the œsophagus and not at an angle to this axis. The ease with which the examination is possible was well demonstrated in Case IX. In looking for an incipient cancer of the œsophagus, I pushed the telescope down at least a half-dozen times, and thoroughly inspected the entire organ until I was certain that there were no pathological changes in the mucous membrane.

I trust that I shall not be misunderstood. Œsophagoscopy will always be, for the majority of patients, a rather disagreeable procedure. The introduction of even a soft stomach tube causes many patients to press and gag. Judging, however, from my experiences and those of many of my colleagues, who were present at my examinations, there is no comparison in the disagreeableness caused by the use of the new instrument to the extreme discomfort to the patient produced by straight-tube œsophagoscopy. I think I have succeeded in constructing a useful œsophagoscope, which answers those requirements that in the beginning of my paper I showed were demanded by such an instrument. To be sure, it has long since been proven that it is possible to inspect the œsophagus by means of a straight tube. That, however, this is the ideal method, which it has been claimed to be by many authors, and that it would not be worth while trying to improve upon this method, has never been my conviction. I think that the unpopularity of the straight-tube method proves that I am right.

I wish now to briefly consider another question. Is there really an actual demand for a useful œsophagoscope? Is there, for example, any necessity for the use of this instrument in the diagnosis of the most common affection of the œsophagus, *i.e.*, carcinoma? It has often been claimed that it is possible to make a certain diagnosis of œsophageal cancer merely from the clinical data without direct inspection. That may be true to a certain extent in the advanced cases with obstructive symptoms, and it is for this reason, namely, that the diagnosis can only be made when the disease has reached an advanced stage, that the attempted radical surgical treatment of this

disease has been so unsuccessful. The symptoms of this disease do not develop over night, and the symptoms of stenosis are merely the last link in the chain of clinical phenomena, which began often many months before. Frequently the patient will state that he was entirely well up to one or two weeks ago. If one goes into the history more carefully, however, one finds that the patient had burning pains in the chest, feelings of oppression, defective appetite, etc., all symptoms which usually began several months before. If we are to accomplish anything in the radical excision of œsophageal cancer, the only time to attack this disease by surgical measures is in the very earliest beginning. For this reason we do need an instrument that is not feared by physician and patient alike. The only possibility of making an early diagnosis of cancer of the œsophagus is offered by direct inspection with possibly a subsequent probatory excision. Even the X-ray is entirely ineffective in these incipient cases.

Œsophagoscopy is often of the greatest importance from the stand-point of differential diagnosis. As was shown in Case V, we were able to differentiate the dysphagic symptoms of a mediastinal tumor from a possible carcinoma of the œsophagus. In Case IX the clinical symptoms suggested a cancer of the œsophagus, but the negative œsophagoscopic findings removed this suspicion, and an exploratory laparotomy disclosed an extensive ulcer of the stomach.

I do not believe that the claim that the rarity of œsophageal affections does not warrant the expenditure of so much time and effort in the construction of a new instrument is tenable. I am convinced that œsophageal disease is by no means infrequent, and when our diagnostic methods have reached a greater state of perfection it will be seen that the lesions of the œsophagus are proportionately of common occurrence.

I would like here to answer an argument that might be advanced against the complexity in the construction of the instrument. There is no question that this new œsophagoscope is decidedly more complicated than the straight tube

that has been used hitherto. When one thoroughly understands the instrument, however, it works with as great a certainty as the straight tube, and if properly handled does not get out of order. I have examined several dozen cases with the same instrument, and it functionates just as well to-day as it did in the beginning. The instrument may be somewhat complicated, but at any rate its construction has been adapted to the patient and not *vice versa*. There is little doubt in my mind as to what choice the patient would make if both models were laid before him. It is immaterial to the patient whether the instrument is complicated or not. The important point is the possibility of a comfortable and certain examination.

A summary of my clinical results is herewith appended.

CASE I.—J. P., male, sixty-two years. (German Hospital, Dr. Kammerer.) Three months ago pain in stomach. This left him, and two months ago he began to have pain low down in the throat and difficulty in swallowing, being able to swallow fluids only. Has lost about 10 pounds during past 6–8 weeks. Never expectorated blood. Never noticed blood in stools. Status: negative, excepting œsophageal obstruction 10 inches from teeth.

March 6, 1912: Gastrostomy (Dr. Kammerer).

April 10, 1912: Œsophagoscopy: ten inches from teeth the œsophagus lumen is obstructed by a cauliflower-like tumor, which occupies about two-thirds of the picture. The tumor's color is dark red, with some yellow spots on it. The other one-third of the lumen, *i.e.*, the part not occupied by the tumor, shows a silver-like color, very distinct from the dark red tumor (colored plate, Fig. 1).

Diagnosis: Proliferating carcinoma of the œsophagus, ten inches from teeth.

CASE II.—R. M., male, forty-eight years. (Mount Sinai Hospital, Dr. Brill.) Previous history negative. Present illness: since three months burning sensation in swallowing beneath sternum and increasing difficulty in swallowing. No vomiting, no regurgitation. Has lost in weight. Status: large axillary glands. Many râles all over chest. Test meal: nothing obtained; tube arrested at 11 inches, followed by some bleeding.

Œsophagoscopy May 1, 1912. Passage into the upper part of the œsophagus easily accomplished. The instrument passes down to 11 inches from the teeth, where it stops on account of obstruction. Œsophagus lumen at this point very narrow. No large proliferating tumor is seen, but a great number of grayish nodules, especially at the posterior wall of the œsophagus (colored plate, Figs. 2 and 3).

Diagnosis: Infiltrating carcinoma of the œsophagus at a distance of 11 inches from the teeth.

CASE III.—S. G., male, fifty-four years. (Mount Sinai Hospital.) Began six months ago with difficulty in swallowing solid food and sensation of pressure and fulness beneath sternum. Epigastric distress after meals. Four months ago discontinued swallowing all solid food on account of gradually increasing difficulty. Lost considerable weight and strength. Forced to vomit often after eating, owing to distress. No blood in vomitus. Stools negative. X-ray shows some dilatation of œsophagus. Bougie goes down to 18 inches (curling up in dilated œsophagus?).

Œsophagoscopy, May 10, 1912: The telescope is pushed all the way down into the œsophagus, but no pathological condition was seen. On the basis of these negatives I differed with the diagnosis made (carcinoma of the œsophagus) and said that we are dealing with a carcinoma of the stomach growing up toward the cardia. On the operating table (second service, Dr. Lilienthal, May 10, 1912) this was verified. A big tumor of the stomach was found, occupying the posterior wall of the stomach and part of the smaller and larger curvatures, going upward in the direction of the cardia, the cardiac end of the œsophagus being smooth and not infiltrated by the carcinoma.

CASE IV.—S. M., male, sixty-four years. (Mount Sinai Hospital Dispensary, Dr. Emil Mayer.) Eight weeks ago pain and burning sensation in swallowing. Can swallow fluids only. Loss of weight and strength. Bougie finds obstruction 6 inches from teeth. Œsophagoscopy May 22, 1912. After extending the telescope to its full length (cardia) a markedly congested area is seen on the left side, covered with whitish nodules, numbering about six. The œsophagus lumen, which was perfectly round in the upper parts of the œsophagus, appears here as a slit with protruding walls. A whitish mass is seen on the right side of the

picture, probably some curdled milk or washed-out food particle. (With forceps this piece could have been removed for examination.)

Diagnosis: Infiltrating carcinoma of cardia (colored plate, Fig. 4).

CASE V.—B. S., female, fifty-one years. (Mount Sinai Hospital Dispensary, Dr. Aronson.) Four months ago substernal pains and difficulty in swallowing solid substances. Attempt to take solid food accompanied by feeling of pressure beneath the middle of the sternum, the food being immediately regurgitated. Noted blood only once. Obstruction seems to have become more marked during the past two weeks, and now patient experiences difficulty even in swallowing semi-solids and fluids. Has lost considerable weight.

Dull area over lumbar interscapular region, with diminished breathing. Œsophagoscopy: The telescope can be pushed down to the cardia without finding an obstruction. The mucous membrane of the œsophagus appears to be perfectly normal. The tumor is evidently extra- and pericesophageal, not intra-œsophageal.

CASE VI.—L. S., male, forty-five years. (German Hospital, Dr. Willy Meyer.) About three months ago horse stepped on his abdomen (upper portion). Did not vomit blood then or since. Pain after accident continued in lower portion of sternum. This pain is increased by motion and by lying long in one position; is not made worse by deep inspiration. One month after accident patient began to hiccough after eating, then vomited immediately after meal; since one month cannot take solid food without vomiting immediately. No vomiting, if he swallows small amounts at a time; frequent belching of gases. General examination negative. Bougie passes into stomach; no obstruction evident at cardia.

Œsophagoscopy June 21, 1912: Very easy introduction of instrument. No obstruction is found in pushing the instrument down to the cardia. The cardia is seen as a small horizontal slot; the posterior wall seems to be somewhat more protruding than the anterior wall. No ulcer seen. No hemorrhage. The illumination of the field was good, though not entirely satisfactory. Operated July 22, 1912, by Dr. Rehling. Carcinoma of the stomach, occupying more than two-thirds of the stomach. Gastrostomy.

CASE VII.—A. K., male. (German Hospital, Dr. Willy Meyer.) Since one year pain and difficulty in swallowing; during the past three months nothing but fluids passed. Bougie blocked at 16 inches.

Œsophagoscopy June 22, 1912: Cocainization of pharynx. Easy introduction of instrument. The telescope is pushed down to about one and one-half inches above cardia, where an obstruction of the lumen is present. The small but clear field of vision shows two very distinctly different aspects of the mucous membrane of the œsophagus. The lower part (anterior wall) is whitish in color (normal œsophageal mucosa), whereas the upper part (posterior wall) shows a dark-red coloration with numerous very small nodules on the surface. The appearance of the area resembles very much the irregular surface of a strawberry (C. p., Fig. 5).

Diagnosis: Carcinoma of the cardia.

Operation (June 24, 1912) (Dr. Willy Meyer).—Extensive involvement of cardiac end of stomach by carcinomatous growth. Gastrostomy.

CASE VIII.—F. C., male, sixty-seven years. (German Hospital, Dr. Willy Meyer.) Since ten weeks feels that food sticks in his throat. Vomited some mucus, no food. Never any blood. Loss of weight 20 pounds. Bougies can only be passed 20 cm. down from teeth.

Gastrostomy: June 10, 1912.

Œsophagoscopy: June 25, 1912. Cocainization of pharynx. The telescope can be pushed down to a distance of 10 cm. above the cardia. At this point the opening is seen as a small slot. At the left side of this slot the normal œsophageal mucosa appears of whitish color and markedly corrugated. The right side of the slot, which is situated somewhat eccentrically, is very much indurated, and shows a few prominent grayish nodules adjoining the border of the œsophagus lumen. More laterally the œsophagus mucous membrane is markedly congested, quite different in appearance from the left side (C. p., Fig. 6).

Diagnosis: Carcinoma of the œsophagus behind the aortic arch. The patient stood the examination extremely well, so that the instrument could be left in place for twenty minutes (in order to show the picture to a number of colleagues) without causing any discomfort.

CASE IX.—G. S., sixty-five years. (German Hospital, Dr. Willy Meyer.) Two months ago began to have sensation at lower end of sternum as if his food stuck. This gradually got worse. Has never vomited, but feels nauseated.

The bougie found some obstruction 8 inches from teeth, but after passing this distance could be pushed all the way down into the stomach. Œsophagoscopy: June 29, 1912. Telescope pushed down under guidance of eye without encountering any obstruction. Mucosa appears perfectly normal on repeated inspection by moving the end of the instrument up and down the whole length of the œsophagus.

Epicrisis: Based on the œsophagoscopy inspection, the suspicion of a beginning carcinoma behind the cricoid could not be entertained. We then came to the conclusion that he was suffering from a gastric and not from an œsophageal disease.

Laparotomy (Dr. Willy Meyer, June 28, 1912) showed a circular ulcer of the stomach (hour-glass stomach), not involving the cardia.

Gastro-gastrostomy was done.

CASE X.—S. B., female, fifty-four years. (Mount Sinai Hospital.) Substernal pain for the last nine months after ingestion of food. Feeling of obstruction. Vomited for four months right after taking food, occasionally bloody. Lost about 30 pounds in weight. Obstruction found 10½ inches from teeth. Tumor bleeds very easily. Œsophagoscopy: July 11, 1912. The upper part of the œsophagus shows a normal mucous membrane and long horizontal slit (C. p., Fig. 7). In pushing down the tube to 10 inches, the opening appears very narrow; the whole surrounding mucosa shows a dark-red coloration. Around the lumen, which is of very irregular outlines, nodular masses are seen, which protrude into the œsophagus lumen (C. p., Fig. 8).

Diagnosis: Carcinoma of the œsophagus 10 inches from teeth. Gastrostomy.

Before concluding my paper, I desire to say a few words in regard to the experiments I have made in attempting to apply the telescopic principle to a gastroscope. These experiments extended over a period of two years, but were abandoned during my experimentation with the œsophagoscope. The optical part of this gastroscope is turned in the stomach by

means of a bevel-gearing, applied for the first time in this connection by Eckstein. With this instrument I have been able to inspect the wall of the stomach in a few cases, but, not having had any tangible clinical results as yet, I prefer to postpone a detailed description of the instrument to some later date.

In conclusion I wish to thank Dr. Heinrich Wolf and Dr. Sidney Yankauer for their many invaluable suggestions and my instrument-maker, Mr. Braunesreuther, for his painstaking efforts during the construction of my instruments.

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INTRATRACHEAL INSUFFLATION ANÆSTHESIA.*

CONSIDERED FROM ITS PHYSIOLOGICAL AND CLINICAL ASPECTS.

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THE problem of artificial respiration—that is, the maintenance of a sufficient supply of fresh air to the alveoli—consists clinically of two separate and distinct processes, one or both of which may devolve upon the physician.

I. The maintenance of an unobstructed passage-way for both the afferent and the efferent air current.

II. The maintenance of a sufficient volume flow of air through such passage-way as may be needed (*a*) to supply the requisite amount of oxygen; and (*b*) to remove the excreted CO_2 .

The method of intratracheal insufflation aëration, without the necessity of respiratory movements, as recently described by Meltzer and Auer,⁵⁰ while ideally simple, fulfils both these conditions and is therefore of great clinical value; this is especially true from the surgical stand-point, as the method likewise permits of the easy administration of the anæsthetic and is particularly applicable to operations within the thorax and those about the head, neck and mouth.

In order to form a correct opinion as to the merit of intratracheal insufflation anæsthesia, and above all to employ the method successfully, it is imperative that one should have the knowledge of the physiological facts on which the method

* Amplification of paper read by the Junior Author to the Obstetrical Society of Boston, November 28, 1911.

is based, as well as the attempts previously made to develop an acceptable technic of artificial respiration devoid of intrinsic danger. Accordingly, an extensive review of the subject seems justified.

Andreas Vesalius,¹ the founder of modern anatomy, discovered that he could prolong the life of an animal after opening its thorax to study the motions of the heart, by blowing through a tube introduced into the trachea. Although Vesalius thus, as early as 1560, in a way, prolonged life by performing artificial respiration with the thorax open, yet we are indebted to Robert Hook,² who lived in the latter part of the seventeenth century, for demonstrating that the respiratory movements were simply for the purpose of bringing about a supply of fresh air to the lungs.

The original account of Hook's fundamental experiment of respiration is so pertinent to our immediate problem that I will quote from his article² delivered before the Royal Philosophical Society on October 29, 1667:

"I did, heretofore, give this *Illustrious Society* an account of an experiment I formerly tryed of keeping a Dog alive after his *Thorax* was all display'd, by the cutting away of the Ribs and Diaphragme; and after the *Pericardium* of the heart also was taken off. But divers persons seeming to doubt of the certainty of the Experiment (by reason that some Tryals of this matter, made by some other hands, failed of success), I caused, at the last Meeting, the same Experiment to be shewn in the presence of this *Noble Company* and met with the same success, as it had been made by me at first; the Dog being kept alive by the Reciprocal blowing up of his lungs with the *Bellows*, and they suffered to subside, for the space of an hour or more, after his *Thorax* had been so display'd, and his *Aspera arteria* cut off just below the *Epiglottis*, and bound on upon the nose of the *Bellows*.

"And because some Eminent Physicians had affirm'd, that the *Motion of the Lungs* was necessary to Life upon the account of promoting the Circulation of the Blood, and that it was conceiv'd the Animal would immediately be suffocated as soon as the Lungs should cease to be moved, I did (the better to fortifie my own *Hypothesis* of the matter, and to be the better able to Judge of several others) make the following additional Experiment:

"Viz: The Dog having been kept alive (as I have now mentioned) for about an hour, in which time the Tryal hath often been repeated, in suffering the Dog to fall into *Convulsive* motions by ceasing to blow the

Bellows, and permitting the Lungs to subside and lye still, and of suddenly reviving him again by renewing the blast, and consequently the motion of the Lungs: This, I say, having been done, and the Judicious Spectators fully satisfied of the reality of the former Experiment; I caused another pair of Bellows, to be immediately joined to the first by a contrivance I had prepar'd, and pricking all the outer coat of the Lungs with the slender point of a short penknife, this second pair of Bellows was mov'd very quick, whereby the first pair was always kept full and always blowing into the Lungs; by which means the Lungs were always kept very full, and without any motion, there being a continual blast of Air forc'd into the Lungs by the first pair of Bellows, supplying it as fast as it could find its way through the coat of the Lung by the small holes pricked in it, as was said before.

"This being continued for a pretty while, the Dog, as I expected, lay still, as before, his eyes being all the time very quick, and his Heart beating very regularly. But, upon ceasing this blast and suffering the Lungs to fall and lye still, the Dog would immediately fall into dying convulsive fits; but he as soon reviv'd again by the renewing the fulness of his Lungs with the constant blast of fresh Air.

"Toward the latter end of the Experiment a piece of the Lungs was cut quite off; where 'twas observable, that the Blood did freely circulate, and pass thorow the Lungs, not only when the Lungs were kept thus constantly extended, but also when suffered to subside and lye still. Which seem to be arguments, that as the *baræ* Motion of the Lungs *without fresh Air* contributes nothing to the Life of the Animal, he being found to survive as well when they were not mov'd, as when they were; so it was not the subsiding or movelessness of the Lungs that was the immediate cause of Death, or the stopping of the Circulation of the Blood through the Lungs, but the want of a sufficient *supply of fresh Air*."

It is idle to attempt to determine who first applied Hook's use of the bellows (introduced into the mouth) to the human being in an endeavor to revive those suffocated by drowning or other causes. The monographs of Goodwyn³ (1788), Fothergill⁴ (1795), and others show that in the latter part of the eighteenth century the bellows were in general use and were recommended by the Royal Humane Society for restoring drowned people; at this time also overdistention of the lungs was well recognized; likewise the danger of blowing up the stomach, when the larynx was obstructed by the tongue and epiglottis, was appreciated. An attempt to avert the first danger was the adoption of the various forms of graduated piston pumps; to avoid the second, traction on the tongue

was recommended, and if this failed tracheotomy was advised.

The use of intubation for keeping the air-passages unobstructed dates from the day in the latter part of the eighteenth century when Desault⁵ accidentally entered the trachea while attempting to perform oesophageal feeding, and found to his surprise that the larynx tolerated the tube for an extended time. As a result, Desault devised the technic of introducing a rubber catheter, carried by a curved probe, into the trachea for the purpose of relieving embarrassed respiration due to stricture of the larynx.

Chaussier,⁶ the French obstetrician, in 1805 combined positive ventilation (preferably by mouth) with a metal tube of proper curve and length to enter the larynx for the purpose of initiating respiration in infants which were born in a state of apparent death. The tube of Chaussier met with considerable favor and was variously modified by Dozes⁷ and others so as to be available for use with the bellows in restoring those suffocated by drowning or other causes.

The potential power of producing harm by the general use of the bellows in the hands of the untrained led LeRoy⁸ in 1827 to make a study of the problem directly from this view-point. LeRoy⁸ presented his conclusions in a memoir to the Academy of Science (Paris) in which he showed that emphysema and even death could readily be caused by a too vigorous use of the bellows by the inexperienced. Therefore he recommended a method of respiration by compression of the chest and abdomen; he, however, approved of the maintenance of a free air-passages by means of a tube introduced into the trachea, and accordingly described an instrument designed to aid the introduction of a soft rubber catheter. Magendie,¹⁰ representing a committee appointed by the Academy of Science to investigate LeRoy's assertions, reported in the affirmative as to the dangers of positive pulmonary ventilation; accordingly the use of the bellows was practically abandoned and along with it the tracheal tube.

Depaul¹¹ in 1845 made an attempt, only partially successful, to again popularize the tube of Chaussier⁶ in the treatment of the drowned and especially in initiating respiration in the new-born. This method, however, fell into final disuse as a result of the efficient and safe method of artificial respiration proposed by Marshall Hall¹² in 1856. Aside from producing contraction of the chest by pressure (with passive expansion) as suggested by LeRoy,⁸ Hall's essential point consisted in maintaining a free air-passages by adopting the prone position, which allowed the tongue and epiglottis to fall forward and therefore out of the way of their own accord.

Bouchut¹³ in 1857-8 clearly and accurately described tubage of the larynx for croup; strong opposition was at once aroused by Trousseau and his followers, who had lately popularized tracheotomy for this con-

dition, and intubation failed to establish itself. In 1871 Weinlechner,¹⁸ apparently without knowing of Bouchut's suggestion, proposed catheterization of the larynx in croup; again the idea did not meet with a favorable reception. O'Dwyer,²⁴ of New York, in 1885 described an exceedingly practical tube and introducer that became at once popular, and which has with a few modifications remained the generally accepted tube for use in diphtheria.

In 1887 Fell²⁵ of Albany saved a severe case of opium poisoning by the use of his laboratory respiration apparatus, consisting of a bellows and tracheotomy tube. Against the opposition of his colleagues he popularized his method as "forced respiration" and claimed it as a wonderful discovery; we have seen above how similar procedures had been used as early as the latter part of the preceding century and that they had been eventually discarded on account of their intrinsic dangers. In 1894 Northrup²⁶ combined the "forced respiration" as described by Fell with the laryngeal tube of O'Dwyer. This Fell-O'Dwyer method was taken up by Matas²⁸ and used in intrathoracic work shortly afterward, and its advantages set forth by him in a masterly monograph in 1900.

Likewise Maydl²⁸ and Eisenmenger,²⁷ both of Vienna, published in 1893 descriptions of tubes modified from that of O'Dwyer, to which they connected rubber tubing, on the end of which was attached a funnel for administering ether after the style of the apparatus used by Trendelenburg¹⁵ for administering the anæsthetic through a tracheotomy wound; they used it for extensive operations about the mouth, for by this means they could pack the larynx and prevent entrance of blood into the trachea and lungs; the patient, of course, had to respire voluntarily.

Kuhn,³⁵ of Germany, has done more than anyone else during the last 15 years in attempting to develop and popularize a laryngeal tube that would be practical and useful in surgical work about the head, neck, and mouth, as well as lately within the thorax. His earlier apparatus, like that of Maydl and Eisenmenger, consisted of a modified O'Dwyer tube to which he attached, by rubber tubing, a funnel. This, of course, increased his "dead space," to avoid which he later used a two-way tube to allow easy exit to the air. Finally, in 1908, he³⁷ adopted a method which came very near being perfect; through a large laryngeal tube he introduced a smaller tube which conducted a steady stream of air into the upper part of the trachea under a constant pressure; the return flow escaped through the space between the inner and outer tubes, the resistance of which created a sufficient pressure for intrathoracic work. Such an apparatus was simple, uncomplicated by valves, and quite efficient; Kuhn's method, however, failed to do away with the dead space between the larynx and the bifurcation of the trachea and so was dependent on respiratory movements to bring about a sufficient exchange of air, and it is in this essential point that it differs from Meltzer and Auer's perfected method. In short, Kuhn never appreciated either the desirability or the practicability of respiration without the necessity of respiratory movements.

The probable great value of some form of static differential pressure

for intrathoracic operations led to considerable experimental activity along this line in the laboratory of Francois Frank, and as a result we find two forms of positive pressure apparatuses emanating from this laboratory as early as 1896. Tuffier and Hallion⁸¹ proposed a method whereby the disadvantages and dangers of pumping air in and out of the lungs were avoided by connecting with a pressure reservoir a tube introduced through the mouth and made to fit the trachea tightly by a specially designed clamp; by suitable valves the expiration was opposed by a water valve of 20 cm. pressure, thus keeping the lungs distended. The exchange of air, however, had to be entirely maintained by the natural respiratory movements of the animal against this pressure. Quénu and Longuet⁸² arrived at the same result by using a head-piece or mask, like a diver's helmet, in which positive pressure was maintained and which proved to be the forerunner of the later improved positive pressure cabinets.

In 1904, Sauerbruch,⁸³ at the instance of Mikulicz,⁸⁸ made a most comprehensive study of the question of surgical pneumothorax. His monograph stands as the basis of all recent work on the subject; in this Sauerbruch followed up the suggestion made by Woillez¹⁸ in 1875 as to the advantages of negative as opposed to positive pressure, and enlarged the latter's "Spirophore," first to a small cabinet just large enough for animal work, and then into his now famous negative pressure operating room with its complicated accessories. The evident excellence of this piece of work, backed by the prestige of Mikulicz, brought about the general acceptance of Sauerbruch's conclusions in regard to the advantages of negative as opposed to positive pressure, notwithstanding the fact that Brauer^{87, 89} and many others soon demonstrated that physiologically there is no difference between the two methods, and that from the practical stand-point the positive pressure apparatus is preferable. All are, in a general way, familiar with the various differential pressure apparatuses as devised by Sauerbruch, Brauer, Tiegel,⁴⁰ Meyer,⁸⁴ Robinson,⁸⁵ and many others, by means of which great advance has recently been made in thoracic surgery; accordingly we will not consider the details of the various modifications.

However, all these differential pressure apparatuses, whether negative or positive or even combined, are designed to render possible *spontaneous respiration* under conditions of surgical pneumothorax; they do not provide any efficient and practical means of aiding respiration, whenever for any cause such spontaneous respiration ceases. Further, it is practically impossible, or at least very difficult, in the case of an anæsthetic accident for the administrator to render material assistance on account of the mechanical interference of the apparatus. In consequence it is no wonder that a method,

such as Meltzer and Auer have described, which when properly conducted renders death from cessation of respiration impossible, whether the thorax be open or closed, has created a tremendous interest in the surgical world.

The first investigator, since the time of Hook in the 17th century, to consider the question of artificial respiration without the necessity of respiratory movements, excepting Nagel³⁴ working on birds, was Volhard.⁴⁶ The latter in 1905, through his pupil Hans Hirsch,⁴¹ published a series of experiments. By the use of a small stream of oxygen introduced a short distance into the trachea, they succeeded in maintaining the animal alive for a period of about two hours, when death would occur from an accumulation of CO₂; if air was used, the animals would die much quicker. The failure of the method was due to the smallness of the oxygen or air stream, which, though sufficient to maintain oxygenation, was not of such volume and pressure as to maintain the lungs in a state of distention, whereby diffusion and the removal of the secreted CO₂ could take place.

Robinson⁴⁸ in 1908 repeated the Volhard experiment through a tracheotomy wound; he came somewhat nearer to the goal in that he used a current of air which maintained the lungs in a state of at least partial expansion; he also recognized the necessity of reducing the dead space for CO₂ retention, though he failed to specifically direct that the tube should be introduced to the tracheal bifurcation.

Let us now briefly enumerate the advantages of the method of Meltzer and Auer^{50, 52} as clinically used.

By means of a soft rubber catheter the air with its requisite amount of ether is carried directly to the bifurcation of the trachea; from this point there is a constant return stream between the catheter and the wall of the trachea to the free air. The size of the catheter should be about a No. 23 F; its exact size in comparison with the trachea is immaterial within considerably wide limits, and we have found this one size to be suitable for all adults. The escape of the air from the end of the catheter and its return through the trachea create air currents in the bronchi which greatly aid diffusion. Therefore it is very easy to supply the patient with as much oxygen as he needs, and also to remove all the CO₂ excreted. If the thorax is opened, the resistance to the outflow is sufficient to maintain the lungs in moderate expansion; complete expansion is not only unnecessary but it is undesirable from

the surgeon's stand-point. If, for any reason, the patient should appear under-aërated, it is a simple matter to interrupt the current for a few seconds and allow the lungs to subside and completely empty themselves, as suggested by Meltzer and Auer in their more recent articles. This, however, is only occasionally necessary, as will be more fully pointed out later. On closing the thorax, gentle pressure on the trachea increases the resistance to the outflow, so that the lungs may be made to completely expand and obviate post-operative pneumothorax. If you have removed a whole or a half lung, do not expect that the remainder can safely be made to fill the thorax immediately.

It is perfectly possible to maintain efficient aëration by this method indefinitely, as Meltzer and Auer's experiments on curarized animals show. We have kept a cat anæsthetized 16 hours by gas and oxygen administered intratracheally with both pleural cavities widely opened; on the discontinuance of the anæsthetic the animal recovered within 15 minutes, though in a state of exhaustion from its all-night exposure in a cold room.

The question of providing a free return of the air through the larynx and mouth must be seriously considered. In the first place, the tongue is apt to drop back and offer just sufficient resistance to direct some of the air down the œsophagus into the stomach. This is quite a common occurrence, and may easily be avoided by holding the tongue forward by either forceps or a stitch.

A more serious question is that of *spasm of the glottis*, in which the vocal cords shut down more or less tightly around the catheter.

This spasm of the glottis only occurs when the patient is light and the administration of ether soon brings about relaxation of the cords. Personally I have never seen the cords grasp the catheter so tightly as to obstruct all reflux of air, and believe its occurrence highly improbable. If complete closure should occur, it would of course be impossible to administer the anæsthetic to bring about relaxation; there-

fore Meltzer and Auer's method of interrupting the air current and allowing the lungs to subside should be intermittently practised until the addition of ether brings about relaxation, when the necessity of this procedure will be found to have ceased. A two-way tube, such as that recommended by Kuhn, we do not like, as it lacks the advantage of blowing out the mucus from the trachea; in oral surgery the prevention of the inhalation of blood is a distinct factor in the preference for a one-way tube.

That spasm of the glottis with partial obstruction to the return flow for a few minutes is common there is no doubt. In consequence, at the very first a mercury safety-valve* of 15 mm. pressure was introduced by us into the air current of the apparatus we used; this factor of safety is likewise incorporated into Ehrenfried's⁷⁵ apparatus. Such a safety-valve effectively prevents any danger of excessive distention of the lungs with resulting emphysema or even death. In a very extensive use of the method in all kinds of abdominal and thoracic work on animals, and a moderate clinical experience, the only death or suggestion of trouble we have seen was due to acute distention of the lungs in a cat by a high pressure. The accident occurred because we had removed from our laboratory apparatus the mercury safety-valve for use in clinical work; after introducing the tube and while washing our hands, and as usual paying no attention to the animal, spasm of the glottis occurred which resulted in death, probably within 15 seconds, as we were using the high pressure supplied by the school. Had the safety-valve been in use when the spasm of the glottis occurred, we should have heard it bubbling; the addition of ether to the air would immediately have overcome the spasm and the animal would have been in no danger.

We are inclined to think that most of the trouble of Meltzer and Auer, as well as others, in obtaining a tube suitable for

* We have repeatedly called attention⁸⁷ to the necessity of a safety-valve; in spite of this accidents are still occurring from failure to have an efficient one on the apparatus.

the case is due to partial spasm of the glottis. Our reasons for this belief are that we always use the same tube for all sized cats and always a No. 23 F soft rubber catheter in our clinical cases (adults), without the suggestion of any trouble other than that noted of temporary partial closure of the glottis. Further, this phenomenon can be readily studied in the cat; with the head extended the cords can be seen partially open; on attempting to introduce the tube when the animal is "light" the irritation of the tube in the pharynx and against the epiglottis causes the glottis to close; therefore in order to introduce the tube the anæsthesia must be pushed to such a depth that the pharyngeal and laryngeal reflexes are overcome—then the cords are seen to be widely open, and they do not contract on introduction of the catheter. After the introduction there is always a free return of air for several minutes or until the cat becomes "light," then the cords can be seen to close around the catheter; the mercury safety-valve bubbles; the tongue and nose become gradually cyanotic, and the animal appears to enter a dangerous state. At first we did not know exactly what to do; experience in a large number of animals has proved that the administration of ether (strong, the current bubbling through the ether) quickly deepens the anæsthesia sufficiently to overcome the reflex spasm; reflux of air takes place and the animal is again "safe."

In one of their earlier papers, Meltzer⁵⁵ and Auer make the statement that an animal cannot be given too much ether by their method, and attempt to explain the fact as an intrinsic virtue of intratracheal insufflation. That they with their apparatus were not able to excessively etherize their animals we do not doubt; their attempted explanation, however, is all wrong, and the error should be strongly brought out. (This they have recently done.) The question of ether dosage is merely the one of proportional arrangement between the volume of the air current and the size of the ether bottle, together with the particular arrangement of the tubes within the bottle. It is easy to arrange the ether bottles and tubes

so that the air in passing through the bottle may take up such a large percentage of ether that the animal dies within five minutes from ether poisoning.

Ehrenfried has adopted in his simple intratracheal apparatus what we have in our gas-oxygen apparatus, namely, an arrangement of tubes and valves so that the air and gases may be passed partly or entirely over the surface of ether or made to bubble through the ether.

We consider it essential for an apparatus for anæsthesia by the vapor method, whether or not intratracheal, that it be possible to give a large percentage of ether for a short period or until the patient is relaxed; as soon as relaxation occurs, and this is possible in every case, including alcoholics, the strength of the ether vapor is decreased or it is entirely discontinued as may be indicated. It goes without saying that liquid ether should not be blown into the bronchi; with positive prevention of this any apparatus is simplicity itself (three inches of glass tubing lightly packed with cotton or gauze inserted into the current). On the other hand we have seen no satisfactory evidence produced that ether vapor, whether or not produced by bubbling a stream of air at room temperature through the ether or by passing it over the surface, causes injury of the lungs provided it be administered in doses suitable for anæsthetic purposes. A very extensive series of major operations on cats (blood-vessels), in which we used the bubble principle exclusively, as it allows us to properly conduct the anæsthesia by stepping on the by-pass tube with our foot, has failed to show any injury to the lungs that can be perceived clinically. There is one point, however, against which we wish to caution in regard to the use of ether vapor methods in which the apparatus is warmed and that is the danger of using too much heat so that pure ether vapor is boiled over; remember that ether boils at a temperature below the body (96.5° F.). Also remember that the excessive cold produced by the evaporation of any liquid occurs at the point where the liquid is converted into a gas; therefore after the change has taken place, on account of the

light weight and actual small substance of a gas, the latter acquires the temperature of its surrounding body without adding or subtracting materially from the temperature of that body (referring to volumes such as would be used for anæsthetic purposes). In other words air at room temperature bubbling through ether is again at the same temperature after passing through three feet of rubber tubing.

Using a small bottle and passing the air over the surface of the ether lowers the temperature of the air in the bottle to such a point that the percentage of ether taken up by the air is below that which produces an anæsthesia of sufficient depth to abolish laryngeal and pharyngeal reflexes. This difficulty can be overcome (*a*) by immersing the small bottle in hot water or other heating device, (*b*) by using a large bottle, thus giving large evaporating surface and therefore capable of being kept warm by the room temperature.

We believe that the air and ether vapor should be delivered to the patient at least within a few degrees of the room temperature; as this is obtained by the use of a large ether chamber and three feet of tubing we do not believe in complicating the apparatus with a heating device. If, however, only a small ether chamber is available, it must be heated in order to get a sufficiently high percentage of ether vapor. We cannot agree with Gwathmey's contention that air and ether vapor *superheated* above the room temperature usually respired is of benefit.

Some anæsthetists make it a practice to combine chloroform vapor with ether either together or in sequence. These combinations are based on the supposed inability to relax the patient by ether vapor; there is no foundation for this supposition, provided the ether bottle is of sufficient size and the tubes are properly arranged. Some two or three decades ago there occurred many deaths in England from the use of chloroform by the closed or vapor method; let us not repeat this sad history by producing a similar series of deaths from the same cause in this country. In contrast to the known great danger of the closed method of chloroform

anæsthesia, the theoretical supposition of lung injury from ether administered by the vapor method of sufficient strength to properly anæsthetize the patient, as opposed to a sufficient amount given by the cone, is too far fetched to be seriously considered by those acquainted with all the available facts. In short we wish to most strongly advise against any such use of chloroform in connection with the intratracheal method.

Instead of ether being carried by an air current as the anæsthetic agent by intratracheal insufflation method, we recently reported the use of nitrous oxide-oxygen-ether as the anæsthetic. A moderate though not extensive use of this latter combination both in humans and in animals still leaves us undecided as to its desirability. We hope shortly to have a series of cases of sufficient length to justify an opinion on the subject.

If it is desired to use nitrous oxide-oxygen as the carrier of the ether vapor, our apparatus⁸⁸ is capable of efficiently and safely doing this. By means of a Y connection the mercury safety-valve is attached. To take care of the irregularity in the outflow caused by the respiration of the patient and to supply the extra quantity of gas-oxygen needed on inspiration, thus obviating the sucking in of air around the tracheal tube, a small rubber bag is inserted near the patient.

The question of the CO_2 content of the blood is one of great importance. Haldane and his co-workers in England have shown that the normal respiratory movements are governed by the percentage of CO_2 in the blood; they have further shown that excessive respiration quickly reduces the total amount of CO_2 in the body, resulting in a condition of apnœa, lasting until the CO_2 is reaccumulated. Henderson⁸⁰ has recently advanced the hypothesis that a material decrease from the normal total quantity of CO_2 in the body, by its effect on the circulation, is as dangerous to life as an increase. The symptoms of an abnormal decrease in the CO_2 content of the body in regard to respiration, if uncomplicated by other stimulating factors, is a condition of apnœa; if hyperpnœa is in any way maintained by artificial respiration

or by strong stimulation of the respiratory centre by pain, the increasing reduction of the CO_2 content shows its harmful effect on the circulation by bringing about a progression of symptoms ending in a picture clinically similar to that commonly known as shock. It is very reasonable to suppose that a material decrease in one of the normal constituents of the body is as harmful as its increase; in consequence, the theory of acapnia and its relationship to shock deserves an extensive clinical investigation to see whether or not it agrees with the findings of the physiological laboratory.

In a brief series of cases we found, at least in certain cases, that there is clinically a relationship between acapnia and shock. These cases will be shortly published,⁹⁰ and it is our hope that some means will be found adaptable to clinical use for the determination of the CO_2 content of the blood; whether or not we will be able to obtain alveolar air for this purpose is questionable, though that at the present time it seems the more practicable method.

In a recent article Henderson states the question of CO_2 relationship in regard to the ordinary administration of ether very clearly. We wish to call attention to a few points in regard to CO_2 elimination by the intratracheal method. By this method increased respiratory movements or attempts at movements will be increased whenever there is an inefficient removal of the excreted CO_2 ; the remedy is to increase the volume of the stream (not the pressure). If the CO_2 is at the normal point, the patient will make what appear ordinary light respiratory motions. On the other hand, as soon as one produces excessive aëration and CO_2 removal, one will produce first a condition of apnœa, which if prolonged will result in the picture of shock; when the apnœic condition develops, one must decrease the volume of air or of nitrous oxide and oxygen and allow a reaccumulation of CO_2 in the body. The aim of the anæsthetist is to maintain the CO_2 content of the blood as near normal as possible; therefore, one should take care to maintain one's volume of air or combined gases so that the patient breathes or rather attempts

to respire in a practical normal manner. In anæsthetic accidents in which apnoea develops as a result of acapnia by the cone method of anæsthesia, it is sometimes difficult to restore respiration before the patient dies of anoxæmia. By the intratracheal method such death from anoxæmia due to lack of respiration is impossible, and with only moderate care not more than a mild condition of acapnic shock is possible; and even this can be avoided by maintaining the patient in such a state that spontaneous respiratory movements occur, though they may be safely reduced both in frequency and depth.

The introduction of the catheter into the trachea when the patient is deeply anæsthetized is comparatively easy by means of the instrument perfected by us,⁸³ provided that the anatomy of the oropharynx and of the larynx is understood. With the patient deeply anæsthetized, the introduction is as follows: Arrange the head so that it is slightly extended; this procedure puts the larynx and trachea on the stretch and the lumen is maintained by the rigidity of the cartilages of the larynx while the œsophagus is pushed back, the pressure tending to keep the latter opening closed. Pull the tongue moderately forward, introduce the finger till it passes over the tip of the epiglottis; insert the introducer with the catheter projecting one-third of an inch, over the back of the finger, along down, hugging tightly the posterior surface of the epiglottis, keeping always in the median line, till the handle of the instrument is at right angles to the body (not at right angles to the mouth if the head is more than slightly extended); then feed the catheter and it will slide directly into the trachea.

However, there is one mistake in attempting to introduce the tube that nearly every beginner makes—that is, depressing the handle of the instrument too far, or in other words carrying it beyond a right angle to the body. This mistake directs the catheter against the anterior wall of the larynx at the base of the epiglottis between the thyroid cartilage and the hyoid bone. This space, as seen on the median section, is merely covered over by the thyrohyoid membrane, over

which are two very thin muscles. In short, pressure here readily develops a pocket into which the tip of the catheter slides and this prevents its further progress. An assistant can materially aid the introduction by gently exerting counter-pressure over the thyrohyoid membrane and the thyroid cartilage.

Personally we have never seen any injury to the larynx by the tube and believe it is unnecessary. To be sure, when learning how, we occasionally slightly injure a urethra in passing a sound, but that is overcome by practice. We believe the same will be found to be true of catheterization of the trachea. If possible, preliminary practice should be made on the cadaver; at least the anatomy of the parts should be well understood. We have heard of one or two cases of aphonia lasting two or three days after a troublesome introduction, but nothing more serious.

The following conclusions we feel are justified:

1. Intratracheal insufflation respiration is the only artificial method that absolutely provides for a sufficient aëration of the lungs, regardless of the respiratory movements of the patient, and that properly administered and safe-guarded can be rendered devoid of intrinsic danger.

2. In consequence, anæsthesia by this method is indicated whenever the operation is about to interfere in any way with the ability of the patient to voluntarily respire.

3. Therefore it ought to be used in all intrathoracic work and in extensive operations about the head, neck, and mouth.

4. Of the various anæsthetics to be used with this method, ether with air, preferably supplied by a foot pump,* is the most applicable for general use; however, nitrous oxide-

* At the new Brigham Hospital the operating rooms are provided with compressed air from the central power plant; we are going to use Connell's meter and percentage ether apparatus by which the quantity of air administered and the actual amount of ether used are determined with nearly absolute accuracy; it is a wonderful piece of apparatus and will be of immense benefit for teaching purposes (paper about to be published). For those hospitals that desire an efficient, simple, and inexpensive apparatus, that designed by Dr. F. L. Richardson of Boston is by far the best (paper about to be published).

oxygen with minimal quantities of ether may occasionally be the anæsthetic of choice.

5. To prevent deaths from emphysema, no matter what form of apparatus is used the same must be provided with a *safety-valve* by means of which the intrathoracic pressure cannot exceed 15 mm. mercury.

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THE ANÆSTHETIC EFFECTS OF THE INTRA- VENOUS INJECTION OF PARALDEHYDE.

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It has long been recognized that paraldehyde is in many ways the most perfect hypnotic we possess. In certainty of action it is unsurpassed, while its stimulating effect upon respiration and circulation and its absence of after-effects are in marked contrast to the depression, immediate and remote, produced by other hypnotics. Given by mouth, its taste is a serious disadvantage, and the preliminary excitement it may sometimes cause is undesirable.

It appeared to us that these defects could be largely overcome by intravenous injection, and the results of our experiments have exceeded our expectations. The hypnotic effect is the most perfect we have ever seen, being exceedingly rapid and yet devoid altogether of unsatisfactory circumstances. The patient appears both to himself and to onlookers to pass into a perfectly natural and easy sleep. Respiration deepens, the pulse is slower and fuller, the color is absolutely unaltered. Yet if the injection be continued deep anæsthesia can be produced with great rapidity. This latter fact opens up a wide field upon which we hope shortly to make a further communication. Here we shall restrict ourselves to the use of paraldehyde intravenously as a hypnotic or as an anæsthetic for minor operations.

Paraldehyde is a colorless, volatile liquid with a characteristic and unpleasant taste and smell. Its sp. gr. is .998, it is soluble in 10 volumes of water at 15° C., less soluble in hot water, and boils at 124° C. It is miscible in all proportions

with ether and alcohol. Under ordinary circumstances it has no depressing effect upon the heart. Intravenously we found it to act momentarily as a depressant. This effect is transient and can be entirely eliminated by combining in the injection an equal amount of ether. The action of paraldehyde is so rapid that we preferred to retard it by dilution. We therefore mix 5 to 15 c.c. of paraldehyde with an equal amount of ether and dissolve the mixture in 150 c.c. of a cold 1 per cent. solution of sodium chloride in sterile distilled water *free from dead bacteria*, or, in default of this, in ordinary boiled tap water. The solution should be perfectly clear after shaking. It is placed in a sterile bottle with a rubber stopper through which pass two glass tubes. To one of these tubes a bellows is attached. The other reaches to the bottom of the liquid and leads off by a long rubber tube to a fine hypodermic needle. The apparatus we have used is that devised by Fildes and Macintosh for the injection of salvarsan. The solution may be injected cold or at a temperature not exceeding 25° C. The patient's arm being surrounded with a light tourniquet bandage, a prominent vein is selected, the skin is cleansed with ether and the needle inserted. A back flow of blood through the needle into a glass tube in the rubber connection shows that the vein has been entered. The tourniquet is removed, the bellows worked, and the fluid is steadily driven into the vein at the rate of 5-10 c.c. per minute. The following phenomena are observed:

In 5 seconds the patient tastes paraldehyde.

In 10 seconds it can be detected in the breath. The patient has a sensation of general warmth.

In 20 seconds the patient has a sensation of floating and perhaps of slight dizziness.

In 30 seconds consciousness is disappearing.

In 40 seconds unconsciousness is complete.

In 60 seconds the patient is deeply unconscious.

In 90 seconds the corneal reflex is absent and anæsthesia is complete. Reflex movements may, however, occur.

Up to this point about 5 c.c. to 10 c.c. of paraldehyde will

have been given and small operations, such as removing teeth or suturing wounds, may be performed. The drug is, however, excreted by the lungs with great rapidity, and for a lasting effect the whole 15 c.c. will usually be required.

The later effects of the drug depend largely on the amount given. With a small dose (5 c.c.) the patient passes through a short period of anæsthesia into an easy and natural sleep. The duration of this appears to depend on the condition of the patient and not on the drug, the action of which is over in perhaps 20 minutes. Thus in a case where six teeth were removed under 10 c.c. of paraldehyde and 10 c.c. of ether the patient was conscious in 20 minutes and had entirely recovered in half an hour. In another instance where the drug was used as a hypnotic six hours of natural sleep resulted. In both cases the patients appeared on waking to have simply been roused from sleep. No after-effects of any kind occurred in either case.

The most striking results were seen in the case of alcoholics, both acute and chronic. One powerful laborer with a scalp wound and incipient alcoholic dementia was sleeping peacefully in 40 seconds, realizing too late that anything was being done. His scalp wound was sutured without disturbance. In such cases, however, intravenous paraldehyde is too transient and should be backed up at leisure with slower drugs, such as potassium bromide and chloral given by rectal or nasal tube, or by paraldehyde itself given in the same way or into the muscles. It is, however, this rapidity of excretion which gives one such confidence in the use of so potent a drug intravenously. At each instant the patient exhibits the maximum effect of the dose so far given. The dosage is, therefore, under absolute control, and hence there is never any danger from an overdose. The moment injection ceases the effect of the drug begins to pass off as the drug itself pours out through the lungs. We therefore consider the use of intravenous paraldehyde to be practically safe, and we have ventured to use it as a hypnotic in cases of grave cardiac and pulmonary disease with perfect success. We do not suggest it can replace the slower but more

lasting hypnotics; but we draw attention to it as a method by which, under the most trying circumstances, we have never failed to induce within 60 seconds a condition closely resembling normal sleep. We feel that such a method must have a future both in medicine and in surgery.

We can find no record in the literature of the previous intravenous use of paraldehyde. We append a list of some of the more important papers on the subject of intravenous anæsthesia.

We should like to thank the staff of the London Hospital for the facilities we have been granted for the introduction of this new method.

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TRAUMATIC RUPTURE OF THE SPLEEN (COMPLETE); SPLENECTOMY.

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THE subject of this report is a young man, 24 years of age, who was received aboard the U. S. hospital ship *Solace* in the early morning of September 9, 1912, with a history of having fallen from the spar deck of the U. S. S. *Ohio* to the water, a distance of forty feet, striking his left side on the gunwale of a whale-boat which was moored alongside the battleship. He was rescued immediately, and, upon being seen by the ship's surgeon, exhibited unmistakable signs of shock, for which he was given morphine, Gr. $\frac{1}{4}$, and atropine, Gr. 1/150, by arm, and preparations made for his immediate transfer to the *Solace*.

Examination on admission to the *Solace* showed the patient's general condition to be very good, with a temperature of 98.4° F., pulse 80 and of good quality, and respirations 29. He was catheterized immediately, and, though the small amount of urine withdrawn was clear, it was sent to the laboratory for examination. The report on this urine shortly afterwards showed it to contain a heavy precipitate of albumin, with numerous granular casts, but no red blood-cells were present. There was evidence of severe contusion over left abdomen and lower ribs, but there was no abrasion of the skin, nor were any bones broken. There was a noticeable rigidity over entire abdomen, and this was markedly increased over upper left quadrant, in which region there was also considerable pain and tenderness. There was no unusual dulness in left flank, and patient had not been nauseated. He complained of a curious, deep-seated pain in left shoulder, which was not increased by movement of the joint, and, as examination showed no contusion or dislocation, it was thought to be a slight sprain in this region, due to an effort to catch himself in falling. It is to be noticed, however, that this pain disappeared completely after operation, and it is possible that it has some diagnostic value when the spleen is traumatically involved.

As there were no signs of internal hemorrhage, it was decided to treat the case expectantly under close watch and at the same time be ready for operation, should one be indicated. In this connection, on account of the condition of his kidneys, it was deemed advisable not to subject the patient to an exploratory operation for diagnostic purposes, but rather to wait until there was more pronounced evidence of internal trouble, and thus not cause what might turn out to be an unnecessary depression of the kidneys incident to the anæsthetic.

For three hours after admission there was practically no change in temperature, pulse, or respiration, and the rigidity in upper left quadrant remained the same. Shortly after this time patient experienced slight nausea and vomited a small amount of light-greenish fluid. There was also at this time what appeared to be an increased desire for water, though there was not the slightest evidence of syncope or restlessness. Operation was decided upon for the following reasons: the continued marked rigidity, in connection with pain, in upper left quadrant, and a slight tendency to nausea. (vomited once), indicating a possible accumulation of fluid in the abdomen.

Operation.—Ether anæsthetic. Incision made along the outer border of left rectus, which was later augmented by transverse incision along lower border of ribs, making in all an L-shaped incision. On opening the abdomen there was at first no evidence of hemorrhage, but, on separating the slightly-distended coils of intestine, small clots began to appear. The spleen was immediately sought for, and a large clot located under the diaphragm and completely surrounding the spleen. A tentative effort was made to deliver the spleen, but, on account of what afterward was discovered to be the shortness of the pedicle and adhesions, this could not be done at this time. The next step was to free the stomach by ligating and dividing the vasa brevia as quickly as possible. This accomplished, the pedicle was secured by a large clamp, guided by the fingers of the left hand. Up to this time the displacement of the clot had caused considerable hemorrhage, but as soon as the pedicle was secured this was seen to be controlled. The clot and fluid blood were now carefully expunged and a better view of the parts obtained. It was noted that not only was the pedicle very short, but the entire posterior border of the organ was held down by reflected

peritoneum or adhesions. These latter were carefully broken up by finger dissection and the lower part of the organ brought up into the wound. It was now seen that the organ had been completely torn across about its middle, and that, in order to secure the pedicle, it would be necessary to include a portion of the tail of the pancreas in the ligature to prevent slipping. This was accomplished with heavy silk, the pedicle being ligated in two sections and the entire organ delivered. The wound, after thorough mopping of the abdomen, was closed in layers, heavy chromic gut being used for the deep sutures and linen for the skin. No drainage was used.

After-treatment and Results.—Patient reacted slowly after operation, and for twenty-four hours normal salt solution was given slowly per rectum for its general tonic effects and to flush out the kidneys. For the succeeding ten days a strictly milk diet was given and the patient encouraged to drink plenty of water. The urine at first showed considerable albumin, with a few granular casts, but by the end of ten days this had entirely cleared up and the patient was put on a more liberal diet of potatoes, toast, butter, and coffee. After this, 24-hour specimens of urine, for two weeks, showed normal quantity and quality, and the examinations were then discontinued. During convalescence there was an indication, at times, of a nervous involvement, such as fleeting headaches, insomnia, and an apprehensive nervous attitude toward attendants. This, however, slowly passed away, and no untoward symptoms were noted, except an occasional colicky cramp over abdomen, which sometimes lasted for twelve hours. An enema and hot-water bag usually relieved these pains. No bone pains were noted, nor was there any enlargement of the superficial glands. The blood picture, as noted by a white, red, and differential count every day, showed nothing unusual or worthy of note. At the present time, one month after operation, patient is up and around, has regained his normal weight, bowels moved regularly, feels perfectly well, eats and sleeps normally, and will be shortly returned to duty.

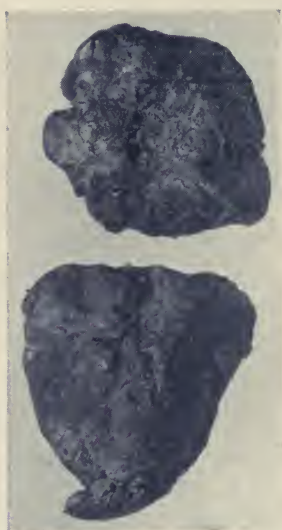
A remarkable feature of this case was the comparatively small hemorrhage present when one took into consideration the

FIG. 1.

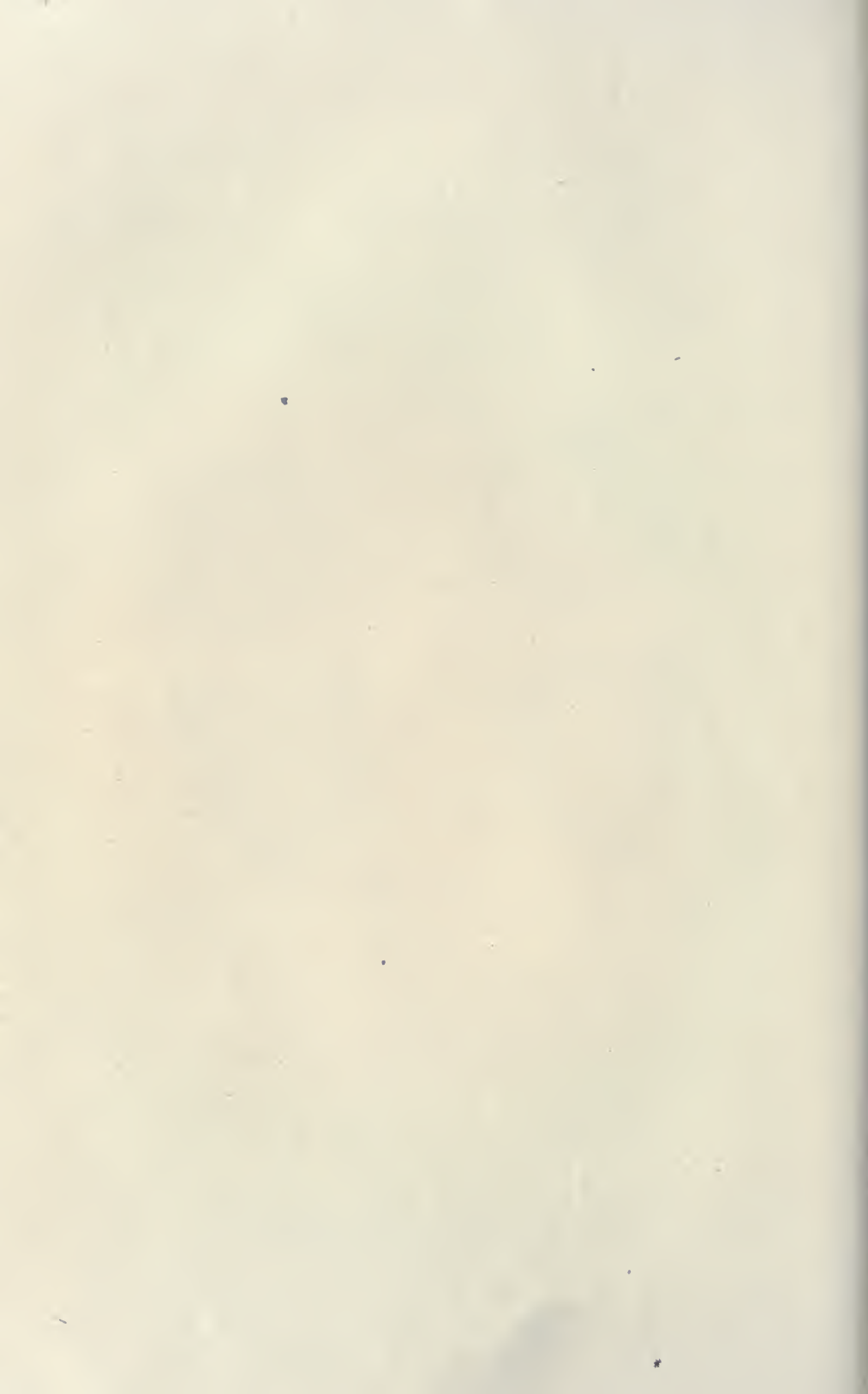


Ruptured spleen, external surface.

FIG. 2.



Ruptured spleen, inner surface.



extent of injury to the organ. One explanation of this may be that the adhesions present bound the organ down in such a way as to limit the flow of blood and favor clot formation. The peculiar pain in the left shoulder, which disappeared after operation, may be worthy of remembering in connection with a traumatized spleen, but only further confirmatory observation along this line could dignify this symptom into anything like a pathognomonic sign.

The accompanying photographs (Figs. 1 and 2) show the internal and external surface of the spleen after the specimen had been in alcohol for two weeks.

SPONTANEOUS RUPTURE OF THE MALARIAL SPLEEN.

A REPORT OF THREE CASES.*

BY LLOYD NOLAND, M.D.,

Chief of Surgical Clinic, Colon Hospital, Panama Canal Zone,

AND

FRED C. WATSON, M.D.,

Colon Hospital.

SPONTANEOUS rupture of the spleen occurring during attacks of malaria, or as a sequel of malarial infection, is, we believe, of sufficient rarity and interest to justify the presentation of this paper. All text-books on internal medicine, and especially those devoted exclusively to tropical diseases, mention and emphasize the fact that the malarial spleen is particularly liable to rupture as the result of severe or even trivial injury. Most workers of extensive tropical experience have frequently encountered such cases. That the malarial spleen may rupture spontaneously is admitted by many writers, but specific instances are rare. We have been unable to make an extended search of the literature on this subject, but the following isolated authentic cases have been found:

CIMBALI, quoted by Litten,¹ observed rupture of the spleen in a man of 65 who had enlargement of the gland, the result of malaria. One morning, as the patient was getting out of bed, he suddenly felt a severe pain in the left side, and soon turned pale and cyanotic and died. A tear, three or four cm. in length, was found in the upper end of an enormously enlarged spleen. Davys, quoted by George G. Ross,² reports a spontaneous rupture of the spleen in a native of India while lying down. Death occurred in one-half hour. Autopsy showed a soft and enlarged spleen with a rent in its anterior angle. Berger, also quoted by Ross,³ reports a similar case. Borrallier, quoted by Douglas,⁴ reports a case of spontaneous rupture of the spleen, following several attacks of ague.

* From the Surgical Clinic at Colon Hospital, Cristobal, C. Z.

Read before the Canal Zone Medical Association, September 11, 1912.

From the clinical and autopsy records of approximately 30,000 cases of malaria, admitted to the wards of Colon Hospital during the past eight years, we have found only three instances of spontaneous rupture. In each of these cases a close and careful questioning failed to elicit a history of trauma of even the mildest degree. In the Isthmian Canal service all employees injured in line of duty receive full compensation during the period of their disability, if not in excess of one year. Employees on the "silver roll" (laborers and so forth) receive no compensation for illness. In consequence of this rule claims of injury are made on the least excuse possible. The denial of injury by these patients is, therefore, of added value.

CASE REPORTS.

CASE I.—N. H., case No. 22,100, Barbadian, male, age 22, black, occupation laborer, on Isthmus 2 years, admitted to Colon Hospital February 2, 1910.

Past History.—Was never sick until after coming to Isthmus. Has never had typhoid or dysentery. Has had four light attacks of "fever" in past two years. Has never been admitted to hospital previously. Denies venereal or alcoholic history.

Present Illness.—Was taken sick January 28 with headache, backache, fever, and pain in left side at costal margin. Continued at work until day of admission, though suffering with fever and headache daily. Has not been injured in any way.

Physical Examination.—Patient well nourished. Lungs and heart negative. Abdomen tender in left hypochondriac region. Slight rigidity of left rectus and oblique. Spleen palpable at costal margin. Tongue coated. Sclera jaundiced. General glandular enlargement. The blood examination was positive, showing a light, æstivo-autumnal infection. Hæmoglobin 68 per cent. Leucocytes 13,100. Stool examination negative. Urine negative.

Case History.—The temperature on admission was 102° F. Pulse 124. Respiration 30. From February 2 to February 6 the temperature ranged from 99.5° to 104°. On February 7, 8 and 9 the highest point reached was 102.5°, and the lowest

100°. The pulse-rate was high for malaria, averaging 110. Routine quinine treatment, grains 15 t.i.d., was instituted on admission. The patient complained of increasing pain in the left side on February 9 and developed marked rigidity of the abdominal muscles. On this day the leucocyte count was 20,000. Differential count: Polynuclears 60 per cent.; small lymphocytes 15 per cent.; large lymphocytes 15 per cent.; transitionals 9 per cent. Blood culture taken February 7 was reported sterile. The patient was transferred to the surgical side with a tentative diagnosis of splenic abscess. Operation was urged, but was refused by the patient on the 9th, 10th, and 11th, but was finally consented to on the 12th. During these days the pain became increasingly severe, with constant and marked abdominal rigidity, but without vomiting or constipation. There was intense local tenderness in the left hypochondriac and epigastric regions.

Operation (February 12, 8 A.M.) (Dr. Noland).—Ether anæsthesia. The abdomen was opened by a free left rectus incision. The peritoneal cavity contained a small amount of dark fluid blood, probably not more than 500 c.c. The spleen was enlarged to almost twice its normal size, and was densely wrapped in omentum, which was separated with some difficulty. A rent of about one and a half inches in length and quite shallow was found on the diaphragmatic surface, almost opposite the hilum. In attempting to determine the extent of this rupture a free hemorrhage was started up. Owing to difficulty of access and the friability of the organ, tamponage rather than suture was deemed most expedient. The hemorrhage was easily controlled by a light gauze tampon, carried out through the upper end of the primary incision. The abdomen was closed in the usual manner. The tampon was removed at the end of 48 hours. The patient made a good and uninterrupted recovery, with the exception of a high postoperative temperature, reaching 105 on the third day, and dropping to normal on the fourth. He was discharged from hospital April 12, 1910.

CASE II.—R. G., case No. 34,260, Spaniard, male, age 31, white, occupation, laborer, on Isthmus 5½ years, admitted to Colon Hospital August 6, 1911, at 7.30 P.M.

Past History.—One previous admission to hospital (Ancon, 1905, with yellow fever). Has never had typhoid or dysentery.

Has had several mild attacks of "fever." Denies venereal or alcoholic history.

Present Illness.—Was taken sick August 2 with chill, fever, intense headache, vomiting, and pain in umbilical region. Continued at work until August 4, though suffering daily with fever. He has sustained no injury.

Physical Examination.—Patient fairly well nourished, though slightly anæmic. The abdomen showed distention and slight rigidity, with decided general tenderness, more marked around the umbilicus. Spleen palpable at costal margin. Heart and lungs negative. Tongue coated. No icterus. Urine shows slight trace of albumin; no casts or sugar. Blood examination was positive, showing a moderately heavy æstivo-autumnal infection. Leucocytes 8,400; stool examination negative.

Case History.—The temperature on admission was 100.5° F. Pulse 120. Respiration 20. Routine quinine treatment, grains 15 t.i.d., was instituted. The following morning the temperature dropped to 99° and the patient seemed very comfortable. At 8 P.M. the temperature rose to 101° and the patient complained of increasing abdominal pain, centring about the umbilicus and radiating toward McBurney's point. The following morning (August 8) there was marked abdominal rigidity and tenderness, with nausea and vomiting. The abdomen was distended and dulness was noted in both flanks. Leucocyte count 17,400. The patient was transferred to the surgical side with a diagnosis of general peritonitis of unknown origin.

Operation (August 8, 10 A.M.) (Dr. Noland).—Ether anæsthesia. Right rectus incision. The abdomen contained approximately 1,500 c.c. of dark fluid blood with few clots. A search for the source of the hemorrhage revealed a shallow rupture on the convex surface of the spleen, some two inches in length, extending backward from the anterior border about one inch above the anterior basal angle. A cauliflower-like mass of blood-clot protruded from the rupture. Palpation gave the impression of extensive infiltration beneath the splenic capsule. The spleen was enlarged to about one and one-half times the normal size. There were no adhesions. Apparently all hemorrhage had ceased, and no further bleeding resulted from manipulation. The abdomen was sponged relatively free of blood;

the appendix, which was adherent and markedly thickened, was removed, and the abdomen closed in the usual manner. There was a postoperative temperature rise to 104° on the day following operation, with a gradual decline to the normal, which was reached on the fourth day. The patient made a good recovery and was discharged on August 27, 1911. Smears of the free blood in the abdomen, made at operation at the suggestion of Dr. J. P. Bates, showed a very heavy æstivo-autumnal infection.

CASE III.—S. W., case No. 36,690, Jamaican, black, male, age 24, occupation, laborer, on Isthmus 4 months, residence Camp Totten, near Gatun. Admitted to Colon Hospital December 16, 1911, at 8 P.M.

Past History.—Has had four attacks of “fever,” although this is his first admission to hospital. Denies venereal and alcoholic history. With the exception of the attacks of “fever” referred to, his health has always been good.

Present Illness.—On the day of admission, while taking his usual midday rest, he suddenly felt a severe pain in his abdomen, most intense in the region of the umbilicus. He describes his pain as being of a sharp and lancinating character, with radiation upward and to the left, being quite severe beneath the costal margin. Respiration increases his discomfort. Soon after the onset of pain he vomited and complained of feeling intensely weak. His bowels moved on the morning of the day of admission. He had been feeling quite well and had worked all morning. No history of injury or strain could be obtained.

Physical Examination.—Patient well developed and well nourished. Facies anxious. Severe pain and discomfort plainly evident. Heart and lungs negative. There was some distention of the abdomen, particularly above the umbilicus. Abdominal tenderness and rigidity were marked. Dulness was elicited in each flank, being slightly more pronounced on the left side. Leucocytes 24,000. A catheterized specimen of urine showed a faint trace of albumin, but no casts and no sugar. The temperature on admission was 99° F. Pulse 100. Respiration 26 and restrained. General condition of the patient was fairly good. A definite diagnosis before operation was not made, although it was thought that there was probably a perforation of some hollow viscus with a rapidly-spreading peritonitis or

slow hemorrhage. The condition was plainly acutely surgical, and immediate operation was decided upon.

Operation (December 16, 9 P.M.) (Dr. Watson).—Ether anæsthesia. A right rectus incision was employed on account of its giving opportunity for a thorough exploration, although the symptoms were slightly more pronounced in the epigastric and left hypochondriac regions. Upon opening the peritoneum there was a gush of bright red blood, estimated as at least 1,000 c.c. A search for the cause of the hemorrhage revealed a shallow laceration on the convex surface of the spleen, slightly below the midline and extending entirely across the organ. Numerous large clots surrounding the spleen were removed and the hemorrhage easily controlled by a light gauze tampon. The patient left the operating room in good condition, pulse 104, regular, good quality. Continuous salt solution per rectum was retained well. The condition of the patient for 24 hours following operation was encouraging, except for the fact that only nine ounces of urine were excreted. Complete suppression followed. The patient died at 1.30 A.M., December 19, 52½ hours after operation. An autopsy by Dr. R. B. Hill, 8 hours after death, showed a very small amount of free blood in the peritoneal cavity, with several large clots in the left hypochondrium. The spleen, when removed, weighed 140 grammes. Opposite the hilum on the convex surface of the spleen there was a superficial tear extending transversely a distance of three inches. Beneath the capsule, and separating it from the gland, there was considerable clotted blood. Smears made from various parts of the splenic pulp were stained and æstivo-autumnal parasites demonstrated. (Repeated examinations of the peripheral blood before death were negative.) The right kidney was small, its cortex was thin, and scattered through the parenchyma were a few small cysts filled with clear, straw-colored fluid. The capsule stripped with a slight degree of resistance, exposing a somewhat granular surface. The left kidney showed similar changes. Opposite the hilum on the convex border there was a cyst the size of a large hen's egg, containing clear, straw-colored fluid. The bladder was empty. The heart showed a moderate degree of hypertrophy. There were a few fibrous adhesions in each pleural cavity. All other organs were normal.

Etiology and Pathology.—Lidell, quoted by R. C. Bryan,⁵ in his very able monograph on spontaneous rupture of the spleen in the course of typhoid fever, states that the causes of spontaneous rupture seem to be several. “(1) Softening of all the structures of the organ, including the coats of the blood-vessels; (2) intense congestion of the portal vein and radicles that occurs in the early stages of typhoid as well as malarial fever; (3) stagnating blood distending the soft walls of the blood-vessels in the splenic surface, thus forcing blood between the spleen tissue and capsule and investing peritoneum; (4) blood increasing compresses the parenchyma on one side and dilates the capsule and peritoneum on the other.”

The above, as a whole, would seem to be a plausible theory in regard to the cause of spontaneous rupture of the malarial spleen. We are inclined to believe, from the evidence afforded by our small series of cases, that rupture of the splenic capsule is secondary to rupture of the engorged capillaries, with hæmatoma formation and consequent increased tension. In Case III there was marked extravasation of blood between the capsule and parenchyma over a considerable area. Case II, at operation, showed a cauliflower-like mass of blood-clot protruding from the rent in the capsule, and palpation over the entire convex surface of the organ gave the impression of extensive infiltration beneath the capsule. In a fairly extensive series of cases of traumatic rupture of the spleen we have never observed infiltration of this character. It would seem that the spleen does not necessarily have to undergo an enormous degree of enlargement for spontaneous rupture to occur. In none of our cases was the organ enlarged to more than twice its normal size. The marked thickening of the capsule and the increased amount of connective tissue in the parenchyma would seem to offer an explanation of the comparative rarity of spontaneous rupture of the large “ague-cake,” so frequently observed in the tropics. As to the situation of the tear, Cantlie⁶ calls attention to the frequency of rupture on the visceral (internal) surface in malarial spleens, the result of trauma. It is interesting to note that in the spontaneous ruptures observed by

us the tear in each instance was located on the diaphragmatic (convex) surface.

Symptoms and Diagnosis.—The symptoms of spontaneous rupture correspond closely with those commonly observed in traumatic rupture. The absence of a history of injury in the spontaneous ruptures, together with their decided rarity, renders the diagnosis much more difficult. Severe abdominal pain, slightly exaggerated above and to the left of the umbilicus, general abdominal tenderness with marked rigidity of the abdominal muscles and some degree of dulness in the flanks, together with a history of previous malarial attacks, or the presence of malarial parasites in the peripheral blood, should lead one to suspect spontaneous rupture. Symptoms of shock and collapse may develop if the tear is extensive and the consequent hemorrhage rapid and severe. Fixed dulness in the left flank, with progressive enlargement of the area of dulness (Ballance's sign) if present, would be pathognomonic of splenic rupture. The symptoms are at times confusing, but even in cases in which the hemorrhage is not sufficiently severe to make an early positive diagnosis easy the indications for immediate exploration are usually unmistakable. The treatment is strictly surgical. Although spontaneous recovery may occur, as noted in Case II, in which the hemorrhage had entirely ceased at the time of operation, such a favorable outcome should not be expected in all cases. The treatment of the rupture will depend upon its extent and location. Splenectomy, we believe, should be reserved for the more extensive lacerations, and cases in which conservative measures for the control of hemorrhage fail. Suture of the congested and friable spleen is always difficult and, at times, impossible. Tamponage, as a means of controlling hemorrhage, has given quite satisfactory results in our cases of spontaneous as well as traumatic rupture. The after-treatment is that of any abdominal section.

CONCLUSIONS:

First.—That spontaneous rupture of the malarial spleen occurs in rare instances.

Second.—That the spleen does not necessarily have to undergo a great degree of enlargement for spontaneous rupture to occur.

Third.—That very deep palpation or forcible percussion of the enlarged malarial spleen should be avoided.

Fourth.—That exploratory puncture of the spleen for diagnostic reasons is not without danger.

Fifth.—That the treatment of spontaneous rupture of the malarial spleen is surgical, and that early operation is indicated in all cases in which the condition is suspected.

We desire to thank Col. W. C. Gorgas, Chief Sanitary Officer, Isthmian Canal Commission, for permission to publish this paper.

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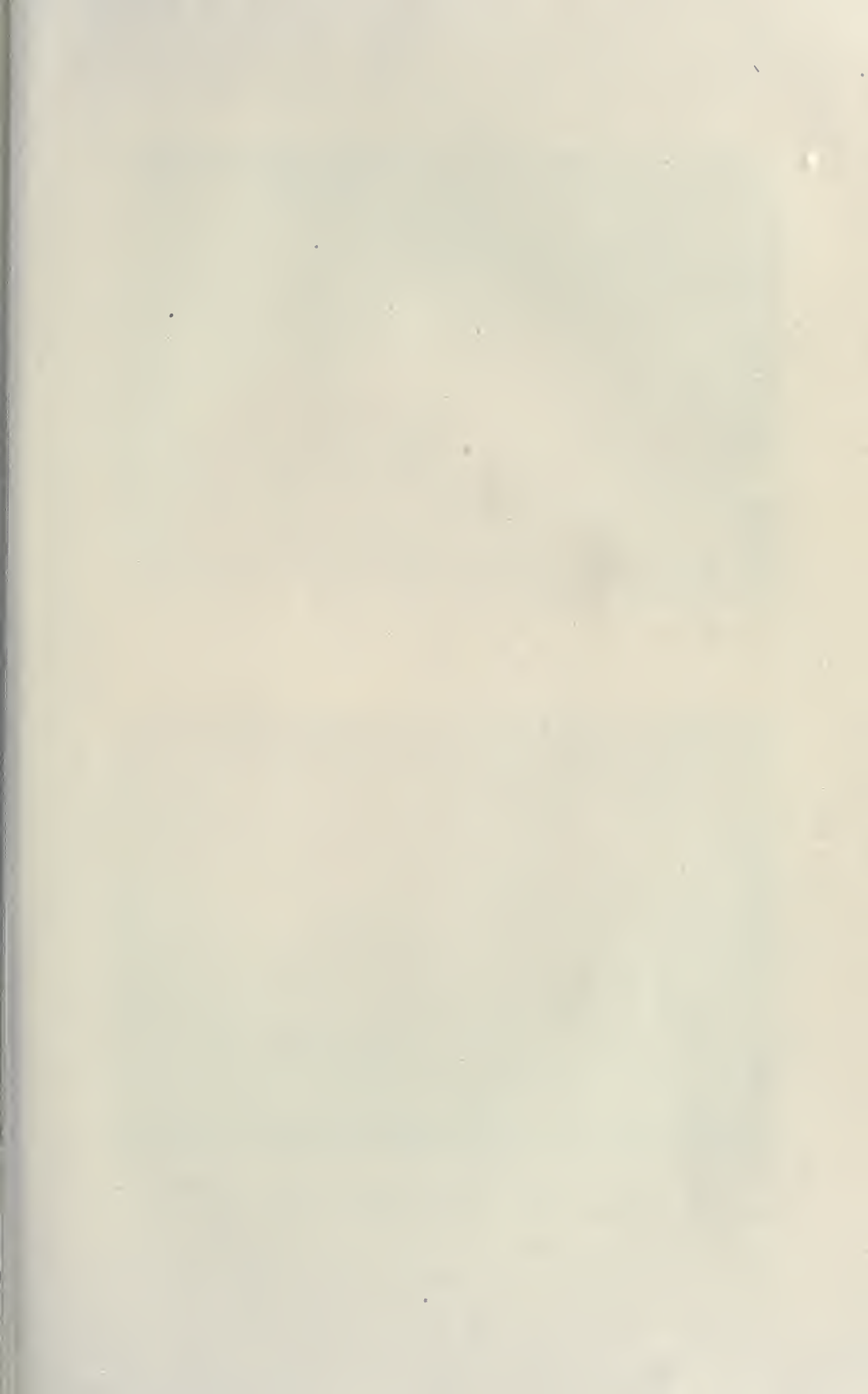
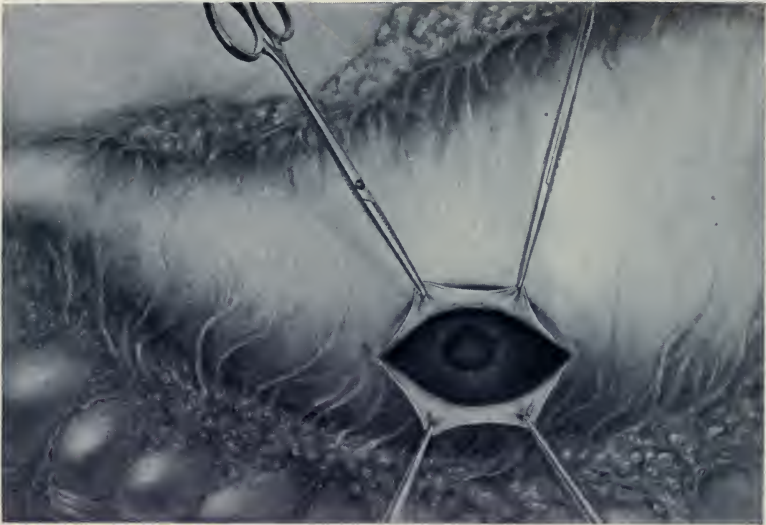
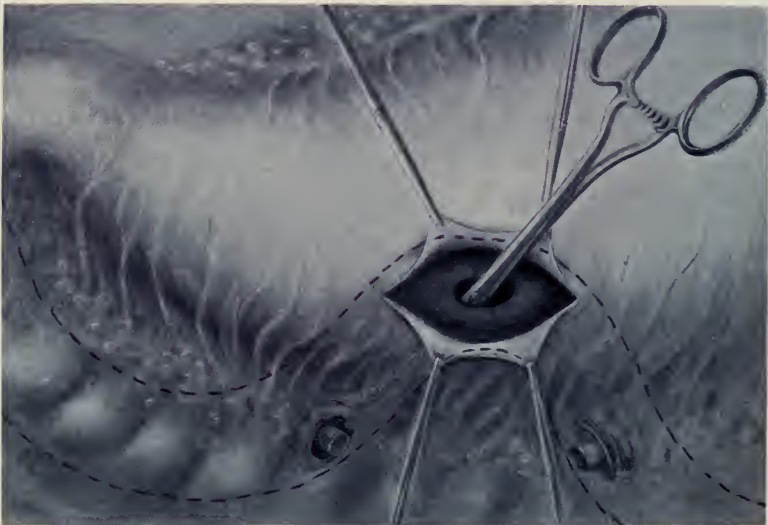


FIG. 1.



The incision in the anterior wall of the stomach allows access to the gastro-enterostomy opening in the posterior wall.

FIG. 2:



The two halves of a Murphy button have been introduced by the transgastric route, caught the two portions of bowel contiguous to the gastro-enterostomy opening and will be telescoped in order to short-circuit the loops for the treatment of vicious circle.

THE USE OF A MURPHY BUTTON TO EFFECT DUODENOJEJUNOSTOMY AFTER GASTRO- JEJUNOSTOMY.

BY WILLARD BARTLETT, M.D.,
OF ST. LOUIS, MO.

NOTHING can distress patient and operator more than persistent vomiting of bile following a gastrojejunostomy. This condition is rarer than formerly, but does occur, although the improved technique of the higher operation has made it less frequent; however, a remedial entero-enterostomy is made more difficult when a vicious circle complicates the higher operation than was the case when a long loop was present.

I have attempted on rare occasions several methods of relieving this unfortunate condition, but have experienced great difficulty with every means except the one described herein.

In a recent case, in which I operated, February 28, 1912, there followed vomiting of bile, which persisted until April 16, 1912. On the latter date the abdomen was reopened and the field found to be deeply placed, fairly well fixed, and with practically no loop.

I was forced to devise a method of short-circuiting the duodenum, which I did in the following manner:

After exposing the stomach, an incision was made in the anterior wall of this structure (Fig. 1), allowing access to the gastero-enterostomy opening in the posterior wall.

With a hysterectomy clamp, one-half of a Murphy button was introduced through the opening in the posterior wall into the duodenum (Fig. 2), then the other half of the button was introduced into the jejunum. Two small incisions were made through the intestinal wall, exposing the neck of each half of the button.

Then the two portions of the bowel contiguous to the gastro-enterostomy opening in which the halves of the Murphy buttons had been placed were brought together and a short

circuit established by telescoping the two halves of the button.

I have found this method extremely easy to accomplish, the only difficulty experienced being in protecting the field with packs.

Following the operation, the patient vomited only once before leaving the hospital, and that a few hours after operation.

ILEUS DUE TO MECKEL'S DIVERTICULUM.

BY ARTHUR BARNETT EUSTACE, M.D.,

OF CHICAGO.

THERE are, no doubt, numerous cases of ileus due to Meckel's diverticulum which are not reported, and, consequently, will not be found in the literature. If these cases are not compiled and published, how shall we be able to arrive at a logical conclusion as to their relative frequency and the different manners in which they may occur?

With the above foreword as a stimulation to others, I herewith submit the data of a case of ileus due to a Meckel's diverticulum in which there were present a volvulus of the diverticulum itself and an obstruction of the ileum produced by it.

H. B., age 11 years, a school-boy, was first seen by me on August 16, 1912, and gave the following clinical history: That he had always been in perfect health until the previous ten days, at which time he was taken with severe cramps in the abdomen, during the duration of which he could not walk nor move without increasing their severity. The first attack of "cramps" was associated with vomiting, and lasted for four or five hours, and were relieved upon his going to bed. A second attack followed three days later, and the cramps and vomiting were more marked than the first. The boy noted that his bowels did not move during this period of "cramps," but moved freely after the cessation of the second attack. The pain and discomfort disappeared without any other symptoms developing.

The boy remained perfectly well for seven days, and at 10 P.M. on the night of August 15 was taken with "terrible cramps" in the abdomen, and a few hours later started vomiting at frequent intervals during the night; the vomitus is described as being black and having a most disagreeable odor.

I first saw the child twelve hours after the onset of this attack, and examination revealed the following: The patient lay in bed

with his legs drawn up, and stated that it relieved the severity of the pain. He complained of pain all over the abdomen, but most marked about one and one-half inches above McBurney's point. The abdomen was markedly distended, and a marked rigidity of the recti muscles, especially the right side, was noted.

The entire abdomen was markedly tender, especially just above McBurney's point. His temperature was 99.8° F. and his pulse 132. Leucocyte count, 17,800.

A diagnosis of acute appendicitis, with possible perforation, was made, being based upon the sudden onset with pain and vomiting and the well-localized tenderness and rigidity, and immediate operation advised. The patient was taken to the hospital within an hour and the following operation made. An effort was made to clear out the lower bowel with a rectal enema just before the operation, with a fair result.

A right rectus incision was made and a large amount of serous fluid escaped when the peritoneal cavity was opened. The peritoneum was "fiery red" and covered with small deposits of fibrin.

Upon attempting to deliver the appendix into the wound a great deal of difficulty was encountered, and after several futile attempts it was decided to enlarge the incision in order to afford a better view of the abdominal contents.

The appendix was noted lying several inches above its normal position and bound down by many adhesions. It was freed and delivered into the wound and found to be perfectly normal except for a moderate injection of the vessels of the serosa.

A marked dilation of a loop of ileum was then noted and an examination of the small bowel made. The ileum was carefully inspected, beginning at its junction with the cæcum, and the cause of the trouble found to be a Meckel's diverticulum located about 20 inches from the ileocæcal valve.

The diverticulum was 9 cm. long and about 3 cm. wide at the base, and tapered gradually to its tip, which was attached to the umbilicus.

The diverticulum was twisted upon itself like the coils of a rope, and was of a dark-brown color, and the normal glossy appearance of a normal serosa had given way to a rough hazy one. Thus we were able to demonstrate a distinct volvulus of the diverticulum itself (see Fig. 1).

A large loop of ileum was shown to be strangulated by the

FIG. 1.



Showing Meckel's diverticulum, causing strangulation of loop of ileum. Twisting of diverticulum shown in large and small drawing.

twisted diverticulum, as shown in the accompanying drawing.

The diverticulum was clamped and cut and the coils of bowel released. Examination of the strangulated portion of the ileum showed it to be in good condition and resection unnecessary.

The diverticulum was then removed by the same technique by which the appendix is usually removed—ligation, amputation, and invagination of the stump. A row of sutures was made over the site of removal to cover over some raw surfaces made by the tearing of adhesions.

The appendix was also removed and the abdomen closed. The patient made an uneventful recovery and left the hospital in 18 days.

Volvulus of Meckel's diverticulum is somewhat rare. When not associated with a strangulation of the bowel it may produce the signs of an acute diverticulitis, viz., pain, rigidity, nausea, and the gradual appearance of the signs of peritonitis.

A diagnosis of ileus due to Meckel's diverticulum seems to me to be impossible unless you have definite knowledge of a persistent umbilical fistula in infancy which may have healed, or an open diverticulum present.

The signs of obstruction due to a Meckel's diverticulum do not differ from those of obstruction due to other causes. A symptom-complex of an abdominal crisis as outlined above constitutes a clear indication for immediate surgical intervention.

EXTRASACULAR HERNIA.

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EXTRASACULAR or sliding hernia of the large intestine or bladder has had but little attention directed towards it, but of late years sufficient interest has been aroused in this condition to show that it is considerably more common than was at first believed. The lesion, when first seen at operation, is very puzzling, not only as regards diagnosis but also as regards the method of treatment. In fact, many methods have been adopted with the idea of preventing recurrence, with apparently but poor results. Thus Carnett,⁶ in his valuable article on the subject, states that recurrences are very frequent, and Lockwood¹⁷ goes so far as to say that the cases are very formidable and "prudence dictates that they should be avoided."

In the first case of this condition upon which I operated a simple method of closure of the sac was adopted, which on theoretical grounds seemed insufficient. A consideration of this case led me to devise a method of operating which I have been able to perform on three subsequent occasions. This method I believed at the time to be new, but, later, careful search of the literature has shown it to be only a modification of a method previously advocated. The good results following the use of it have, however, led me to publish these cases, so that further attention may be directed towards this condition. The first of the four cases is as follows:

CASE I.—A. N., a male, aged 46, stated that 12 years ago he first noticed a swelling in the right inguinal region. It came on during an effort with considerable pain, and has been steadily increasing in size since. On examination he was a poorly-de-

veloped man, with weak abdominal walls. There was a large right inguinal hernia passing along the whole length of the inguinal canal which was only reducible in part. There was nothing else of note in his condition.

Operation (November 8, 1909).—A 4-inch incision was made over the right inguinal canal, the aponeurosis of the external oblique cleared and divided. The sac was found opened, and a coil of small gut with a portion of omentum reduced. It was then noticed that the cæcum was projecting into the postero-external part of the sac so that its anterior surface was alone covered with peritoneum. About one inch of the cæcum projected from the abdomen. The sac was freed as far as possible, the redundant portion removed, and the opening closed with a continuous suture. The cæcum and attached peritoneum were then pushed back into the abdomen and the conjoint tendon sutured to the deep surface of Poupart's ligament over the cord after the manner of Macewen,¹⁹ sharp curved needles and chromic catgut sutures being used.

The wound healed well, and he was discharged three weeks later.

At the present date, in answer to inquiries, he states that the pain and swelling have returned, but to a less degree than previously.

The above operation seemed at the time insufficient, for not only was the cæcum inadequately reduced, but even when the excess of sac was removed a distinct pouch was kept which was simply pushed back into the peritoneal cavity, the attempt at a radical cure resting wholly upon the repair of the muscular wall, a method which has frequently been shown to be inadequate, and recurrence, as took place in this case, being probable. It seemed necessary to free the cæcum before replacing it, as well as to overcome any dimpling of the peritoneum at the site of the sac. I therefore devised the following operation:

The usual incision having been made, the aponeurosis of the external oblique is slit up in the line of its fibres and the sac laid bare. This latter structure is carefully freed from the surrounding structures of the cord and opened at the fundus. The opening is enlarged along the anterior surface of the sac

so that the contents are freely visible. The condition then seen will be that depicted in Fig. 1. The sac is now divided with scissors on the posterior aspect to within one-half inch of the caput cæci, the incision being then carried along either side of the cæcum as far as the neck of the sac and at a distance of one-half inch from the lateral walls of the cæcum (Fig. 1). On pulling the cæcum forward two flaps of peritoneum are thus seen (Fig. 2), which are sutured together so as to surround the bare posterior surface of the cæcum, and the two edges of the divided sac are also sutured together behind the cæcum. This latter structure now lies free in the sac and can readily be reduced into the abdomen. The sac, being restored, can be invaginated and pushed through the internal oblique by Kocher's ¹⁶ second method. By this means the neck of the sac, with the attached part of the cæcum, is pulled up well away from the internal ring, while the freed cæcum is returned to the abdominal cavity. The muscular and aponeurotic wall is then carefully restored.

The three cases in which this operation was carried out were as follows:

CASE II.—W. M., aged 36, stated that four years ago he noticed a swelling in the right groin. His attention was first directed to it by the presence of pain while lifting a heavy weight. The swelling has been increasing since, but is lessened when he lies down. He has never worn a truss. On examination a right inguinal hernia was seen which was only in part reducible. The abdominal muscles were well developed.

Operation (December 10, 1910).—The cæcum alone was found in the sac and was in part extrasaccular, the posterior wall being bare. An operation on the above lines was carried out, and the conjoint tendon sutured over the cord to the deep surface of Poupart's ligament with chromic gut. Three months later he returned with a hydrocele of the right tunica vaginalis, for which an operation was performed. The site of the hernia was in perfect condition. At the present date he writes to say that he has never had any return of the pain or swelling and is able to carry on his work as a dock laborer in perfect comfort.

CASE III.—F. P., a male, aged 30, stated that he noticed the sudden onset of pain in the right inguinal region two years ago while carrying a heavy weight. Soon afterwards he noticed a swelling, which has steadily increased in size. He has never worn a truss. On examination there was seen a large right inguinal hernia which passed down to the top of the testis. The testis was small and atrophic. A thick-walled sac could be felt.

Operation (September 5, 1910).—The sac was large and the upper part contained a large mass of omentum and a portion of cæcum corresponding in size and position with the last case. An operation was carried out on the above lines and the muscular canal restored. At the present date he writes that there has been no return of any pain or swelling. He has not worn his truss since operation, and has returned to his usual work.

CASE IV.—L. N., a male, aged 68, stated that he had a rupture for fifteen years, for which he had always worn a truss. For four weeks there had been pain in the swelling, and for seven days this had been severe. He had been unable to completely reduce the hernia for six months. On examination there was a large left inguinal hernia which was only partly reducible, his general condition was poor, and he showed signs of two previous attacks of right-sided hemiplegia, but owing to the amount of pain operation was decided upon.

Operation (April 4, 1911).—On opening the sac a loop of large intestine was seen, the upper two inches of which had no mesentery, the gut, which was evidently iliac colon, being in this position partly extrasaccular. An operation on the above lines was carried out. Convalescence was uninterrupted, and at the present date he writes to say that he has never had the slightest trouble with the hernia since operation, and has not used his truss since.

It will be seen, therefore, that in the first case, with simple closure of the sac, reduction of the gut, and suture of the muscles, there is a definite return of swelling and pain. In the three cases treated by the more complete method there is no trace of any recurrence, although one patient is 68 years of age, and the other two have returned to hard work for a period of nearly two years.

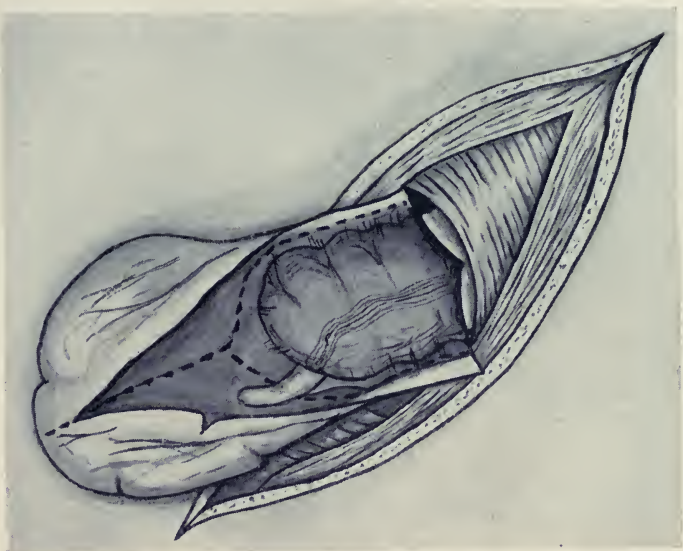
In the case of an extrasaccular hernia of the bladder a simi-

lar operation can be done, but in this case the bladder is pulled outside the sac before the edges are sutured. An incision in this case is made on the inner and posterior walls of the sac close to the prolapsed bladder and continued on either side of this viscus up to the neck of the sac (Fig. 1). The sac is now pulled forward and the bladder backwards and the edges of the sac sutured together (Figs. 6 and 7). By this means the bladder is left wholly without the sac, which is invaginated in the usual way. The freed bladder is now returned beneath the muscles into the cave of Retzius and the muscular and aponeurotic wall of the abdomen firmly repaired. The following is a case treated in this manner:

CASE V.—P. C., a male, aged 44, stated that ten years ago he first noticed a swelling in the right inguinal region which came on during an effort and was associated with considerable pain. It has been steadily increasing in size since. Eight years ago he first noticed a swelling at the upper part of the umbilicus, which has also slowly increased in size. On examination, a stout man with a large, prominent abdomen. There is a small hernia at the upper part of the umbilicus which is not wholly reducible. There is also a large right inguinal hernia which is wholly limited to the lower part of the inguinal canal and therefore appears to be direct. It passes only part of the way down the scrotum, and is reducible in greater part, but not wholly.

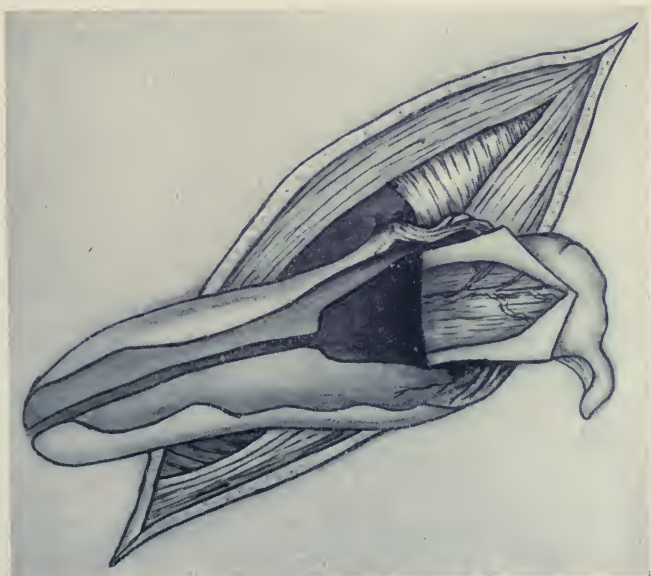
Operation (January 6, 1910).—A transverse elliptical incision $4\frac{1}{2}$ inches long was made round the umbilicus and this hernia repaired according to the method advocated by Mayo.²¹ A 4-inch incision was then made in the right inguinal region, the aponeurosis of the external oblique being cleared and slit up. A large sac was seen in the position of the external ring. It was covered with a thin aponeurotic layer, which was seen to be the stretched conjoint tendon, through a well-defined opening of which the hernia escaped. Below and internal to the sac a large pouch of bladder was found to be attached. The rest of the operation was carried out on the lines described above. The opening in the conjoint tendon was sutured with chromic catgut. The conjoint tendon was also sutured to the deep surface of Poupart's ligament, over the cord, after the method of Macewen,¹⁹ an ordi-

FIG. 1.



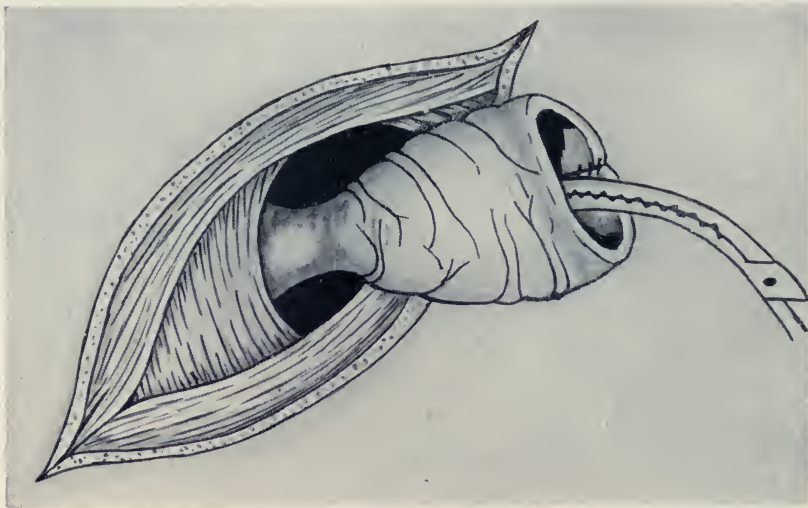
Sac laid open to show position of cecum with lines of incision. (An excessive amount of the anterior wall of the sac has been removed to show details.)

FIG. 2.



Cæcum pulled forward to show peritoneal flaps.

FIG. 4.



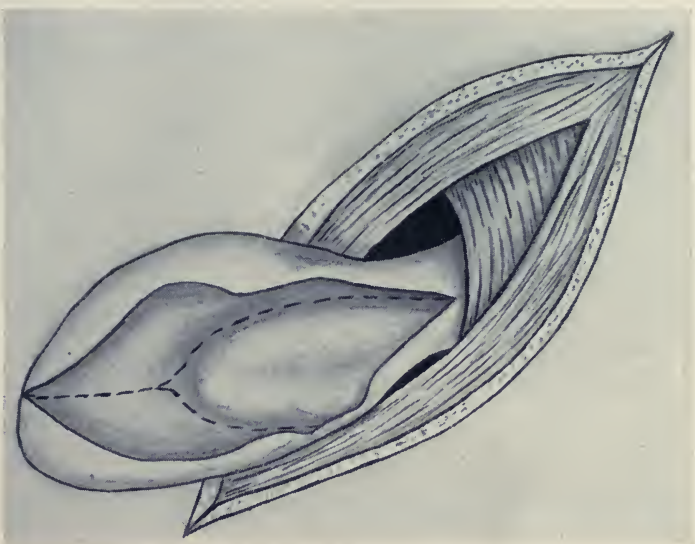
Freed cecum reduced. Commencing invagination of reconstructed sac.

FIG. 3.



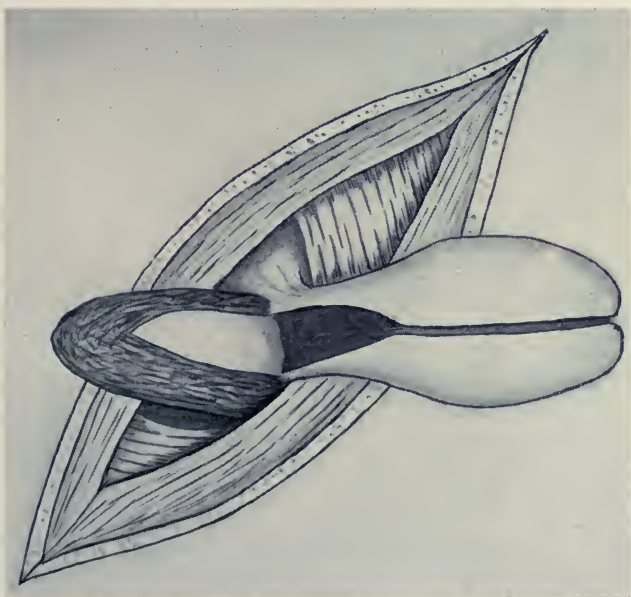
Suture of peritoneal flaps on cecum and restoration of sac.

FIG. 5.



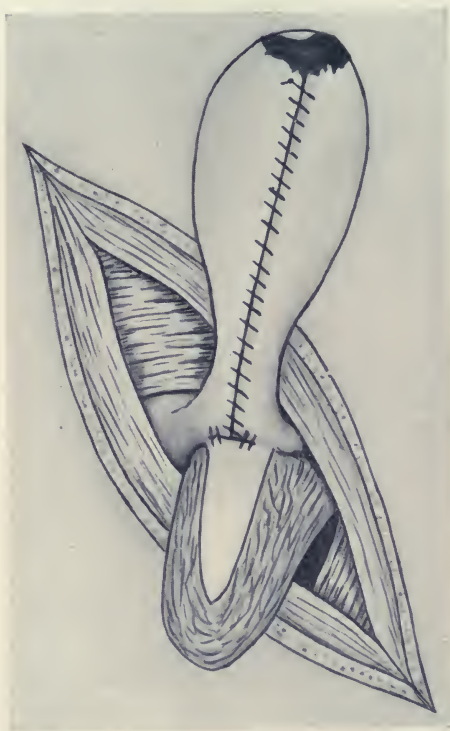
Sac laid open to show position of bladder. Line of incision indicated.

FIG. 6.



Bladder pulled downward and sac upward.

FIG. 7.



Sac reconstructed and ready to be invaginated. Bladder freed, displaced outside sac, and ready to be returned to cave of Retzius.

nary sharp-curved needle being used. The wound healed well and he was discharged three weeks later. In answer to inquiries he states that at the present date he has no trouble with either hernia and is able to carry out his usual work in comfort.

Extrasaccular herniæ are those in which some portion of the wall is formed by a viscus which in its normal position is only in part covered by peritoneum. It is thus seen that this viscus, in the inguinal or femoral region, may be either bladder, cæcum, or iliac colon.

Hernia of the Bladder.—This condition is now recognized as being a very common complication of both femoral and inguinal herniæ. Although it has been known for many years and was, in fact, mentioned by Albucasis in the twelfth century, and Guy de Chauliac described the passage of a catheter as an aid to diagnosis in 1363, yet its frequency has only of late been appreciated. In the extensive article on hernia by Birkett,³ in 1883, there is no mention of this condition. Cases of the presence of the bladder in an inguinal hernia were, however, described by Cloquet,⁷ and in 1889 Lockwood¹⁷ mentions a case where the bladder was injured in drawing down the sac to ligature it. Within the next few years the condition became well recognized, and in 1900 McAdam Eccles¹⁸ stated that it was probably associated with nearly 1 per cent. of inguinal herniæ. He described three varieties.

I. With peritoneal covering. These occurred within the sac of a large inguinal hernia, and through a greatly dilated, deep abdominal ring.

II. Where the bladder forms part of the wall of the sac. This is the commonest variety, the bladder being situated on the inner wall and having only a partial peritoneal covering.

III. Where the bladder descends without any peritoneal covering whatever.

This classification is maintained to-day, although there is some doubt as to whether it is ever possible to find a hernia consisting of bladder alone, it being generally considered that a peritoneal sac, though often small, is always present.

The cause of the presence of the bladder appears to be undoubtedly that this viscus is dragged downwards by the peritoneum in the formation of the sac. The sac is generally large and the hernia of old standing. It must be remembered that the peritoneum is firmly attached to the posterior and superior surfaces of the bladder, and thus as the sac increases at the expense of the parietal peritoneum it will gradually come to drag the attached bladder with it, and thus a portion of this viscus will come to form the inner and posterior wall of the sac. In many cases an early stage of this condition may be seen; that is to say, the extraperitoneal fat which surrounds the bladder is often seen to occupy the position which the bladder, if prolapsed, would attain to, although so far the bladder is still within the abdomen.

This explanation, although undoubtedly referring to the great majority of these herniæ, does not seem to make clear those rare cases in which a small peritoneal sac is alone present, or those in which the bladder is present within the sac. These latter do not come within our present consideration, but the former may be explained by the suggestion put forward by McAdam Eccles¹⁸ and supported by Sir B. G. A. Moynihan,²⁶ namely, that the bladder is dilated and hypertrophied by obstruction from a stricture or an enlarged prostate and thus may come to overlie the opening of the abdominal ring.

The presence of the bladder in femoral herniæ seems to have been recognized even more lately. No mention of the condition is made by Birkett³ or Lockwood.¹⁷ McAdam Eccles¹⁸ states that on several occasions this viscus has passed into a femoral sac. Moynihan²⁶ carefully investigated the condition and collected twenty-nine cases, two of which were males and twenty-seven females. Since then a very large number of individual cases have been recorded, and, as Erdmann⁸ mentions, it is now recognized that the bladder is more commonly prolapsed in this type of hernia than in the inguinal variety.

The bladder will be situated on the inner side of the sac wall, and the cause of its presence will be similar to that of the inguinal type.

Symptoms.—The symptoms of the presence of the bladder are often ill defined, and in the majority of cases this viscus is only found at operation, the condition having been previously unsuspected. Such herniæ are, however, large and always irreducible in part, so that the fact that the patient has a relatively large hernia which is reducible in part only should raise the suspicion that the bladder is associated with a part of the sac wall.

In other cases more definite signs and symptoms may be present. According to McAdam Eccles,¹⁸ it may be possible to discern a fluctuating swelling in the hernial region which swelling is dull on percussion. Micturition may take place in two stages: the bladder is emptied and then by some movement the urine passes out of the hernial portion and is expelled, the tumor at the same time being noticed to disappear. In other cases pressure upon the hernial sac may be associated with a marked desire to micturate, as in a case recorded by Noall.²⁷ In such cases artificial distention of the bladder may be followed by an increase in size of the hernial swelling.

Even at operation the condition is not always easy to diagnose. The muscular fibres of the bladder wall are in large part covered by and infiltrated with fat, so that there is a danger of the condition being mistaken for the extraperitoneal fat alone, so that most surgeons have seen or heard of cases in which the viscus has been either inadvertently opened at operation or injured while the neck of the sac was being closed, an accident which is not uncommonly followed by fatal results. When once the frequency of the condition is realized, however, the presence of a considerable mass of tissue in this situation will at once give rise to the suspicion that the bladder is present. A finger inserted inside the opened sac will enable the amount of this tissue to be more readily estimated, and it may be determined thereby that it forms part of a hollow viscus. If any doubt should still remain, it would be possible to make the condition certain by injecting fluid into the bladder through a catheter.

The treatment will depend upon the amount of bladder

which is prolapsed. If small, this may be separated from the sac as high as the neck of the latter, which is then dealt with in the usual manner. The prolapsed portion of bladder which is now quite free is pushed back into the extraperitoneal space and the opening in the muscular and aponeurotic portion of the abdominal wall firmly closed. If larger, such a procedure might be associated with considerable injury to the bladder wall. It is therefore wiser to cut the free portion of the sac away from that attached to the bladder and then restore and treat the sac in the manner already described.

Hernia of the Cæcum.—The presence of a portion of the cæcum in association with a hernial sac has also had more attention devoted to it of late. Cases were, however, figured by Scarpa³¹ in 1814. Mitchell Banks²³ described the condition fully and first made use of the term now so commonly used of landslip of the cæcum.

In the case of this viscus the relationships are complicated by the varying attachments of the peritoneum to the cæcum when this latter is situated in its normal position. Thus of the five cases described by Lockwood¹⁷ the cæcum in four retained in its entirety its serous covering, but in the fifth it was partially denuded. Tuffier³⁶ has described a case in which there was no trace of a sac, but Treves³⁵ states that in all cases a sac is present, although in many such it may be very small.

The developmental changes occurring in and around the cæcum throw considerable light upon the presence of these different types. The cæcum develops as a small diverticulum as early as the end of the first month of foetal life (Bryce⁶); that is, before the axial rotation of the gut is complete and while there is still a common mesentery. It thus happens that the cæcum itself, which is usually about two and a half inches long, has a complete covering of peritoneum and has no mesentery attached to it, but lies free in the peritoneal cavity.

In early embryonic life the whole of the large gut has one common mesentery, which persists until the seventh week, when axial rotation of the U-shaped loop takes place, by which means the cæcum is carried over to the right side of the abdomen.

CÆCAL HERNIÆ.

FIG. 8.

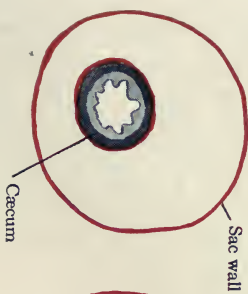


FIG. 9.

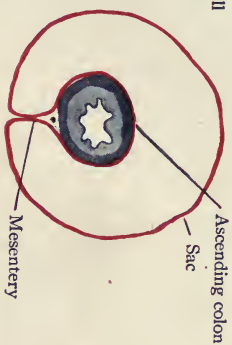
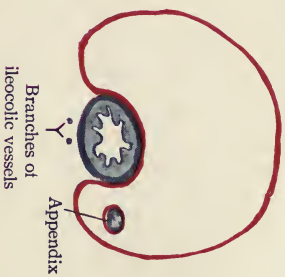


FIG. 10.



COLIC HERNIÆ.

FIG. 14.



FIG. 11.



FIG. 12.



FIG. 13.

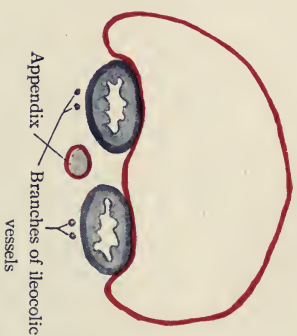
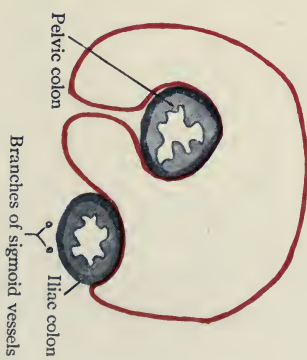


FIG. 15.



At this stage then the ascending colon has a well-defined mesentery, while the cæcum forms a free diverticulum covered with peritoneum. The ascending colon now falls over to the right, so that the lateral aspect of its mesentery comes to lie in contact with peritoneum covering the posterior abdominal wall. These two layers then fuse and become absorbed, so that the peritoneum comes to be directly reflected off from the cæcum onto the posterior abdominal wall, and the usual condition in one of only a partial covering of peritoneum for the ascending colon, while the cæcum is free. In a small number of cases the colon may retain its mesentery, and Carnett⁶ states that always in the newly-born, and usually in the adult, the two adherent layers can be separated and the primitive mesocolon reëstablished.

As the cæcum falls over to the right the appendix may get caught between the two layers and come to occupy an extra-peritoneal position (Keith).¹⁵ In addition to these changes, the ascending colon may, after fusion has taken place, again develop a mesentery, in its lower part at least, probably by stretching of the peritoneal folds. In a certain proportion of cases—according to Jonnesco,¹⁴ 8 per cent.—the cæcum may in its upper part undergo changes similar to those of the ascending colon, so that it also may be in part uncovered by peritoneum.

A consideration of the above factors makes it clear that many different varieties of hernia of the cæcum may take place, and, as Sobotta³³ has shown, the cæcum, when distended, lies in contact with the anterior abdominal wall, so that its appearance in the sac of an inguinal hernia is not unlikely. Although most common in an inguinal hernia, this viscus may also pass through the femoral opening. The statistics of Hildebrand¹¹ and Gibbon,¹² combined by Carnett,⁶ showed 164 inguinal and 21 femoral varieties.

The condition found at operation will, of necessity, be of one of the three following types:

I. *Simple Hernia*.—Here the cæcum has descended into the hernial sac in a manner identical with any coil of small gut (Fig. 8). In some cases only the appendix is present, as in

4 cases recorded by J. A. Macewen,²⁰ and while in this situation may even become acutely inflamed, as in cases described by Ewart.⁹ In others the cæcum itself will also be prolapsed.

It will be seen that the condition may arise in one of three ways:

- (a) From a persistence of the embryological condition of a mesentery to the ascending colon.
- (b) From the presence of an acquired mesentery to the ascending colon.
- (c) From the presence of a large cæcum or appendix, so that one or both are able to pass down into the sac, while the ascending colon maintains its normal position and relationships to the peritoneum.

The gut, in either case, is reduced with the same simplicity as the small gut, no difficulty arising in the operative treatment.

II. *Extrasaccular Hernia*.—This presupposes the presence of a sac, but the cæcum or ascending colon is either definitely outside the sac in part or the mesentery of these structures is firmly attached to a portion of the sac, so that simple reduction becomes impossible.

For such a condition to occur it is necessary that the cæcum slide down from its normal position. This sliding down of the cæcum may be due to congenital or acquired causes. The congenital are described as being two in number:

- (a) In foetal life a fold, known as the plica vascularis, is seen to run up from the mesorchium along the posterior wall, to end in the cæcum, appendix, mesentery, and ileum. Lockwood¹⁷ regards the persistence of this fold as a developmental defect, and figures cases of cæcal hernia in which its presence was well marked. In one case in a child he was able to demonstrate gubernacular fibres passing up in this fold. He suggests that the testicle in its descent pulls upon the cæcum by means of this fold and thus drags downward the cæcum to form a hernia of this type.

- (b) Adhesions may be formed between the posterior surface of the cæcum and the peritoneum covering the yet undescended testicle (Carnett).⁶ The cæcum will then be dragged down with the subsequent descent of the testis.

The acquired condition is much the more common and is more comprehensible. Either there is a preliminary prolapse of the viscera on the posterior abdominal wall—in fact, a condition of enteroptosis, so that the cæcum lies at a lower level than normal and thus the retroperitoneal area lies in closer contact with the inguinal or femoral opening, and thus can easily prolapse through it—or, more commonly, a simple hernial sac is formed which enlarges, and, as it does so, drags down the peritoneum on the posterior abdominal wall. The cæcum, colon, and appendix, being firmly attached to this portion of peritoneum, are also dragged down and thus come to form the upper and posterior part of the sac.

That portion of the colon which in the abdomen was extra-peritoneal will therefore come to lie outside the sac wall, the condition being then exactly comparable with that of an extrasaccular hernia of the bladder; but, as would be expected, prolapse of the bladder is more common in femoral herniæ, that of the cæcum in the inguinal variety.

In the majority of cases the cæcal hernia is found on the right side, but at times it is present on the left side, Foerster¹⁰ being able to collect 54 cases. In most of such cases the cæcum was intrasaccular, and, indeed, it would be difficult to see how an extrasaccular hernia could occur in this position unless a condition of situs inversus were present.

Many different degrees of this type of hernia may be seen, but they may all be grouped under the three following headings:

- (a) In this type there is a definite mesentery to the lower part of ascending colon, either of congenital origin or due to dragging upon the peritoneal attachments by the displaced cæcum. This mesen-

tery is attached to the posterior wall of the sac for a greater or lesser degree; thus reduction of the cæcum and colon becomes impossible unless the sac be reduced also. It will be seen that the branches of the ileocolic artery will enter between the two layers of this mesentery and thus will be running upon the posterior surface of the sac and therefore be liable to injury.

This variety, then, is characterized by the presence of a single piece of gut attached by a mesentery to the posterior wall (Fig. 9).

- (b) In this variety there is no mesentery to the colon, this viscus having prolapsed through the ring while maintaining its normal extraperitoneal position; thus the sac will lie in front of the colon and only cover its anterior surface, the posterior surface of the viscus lying in direct contact with the posterior wall of the inguinal canal. The ileum, and generally the appendix, will maintain their normal peritoneal relationships, and thus will lie wholly within the sac, the relationships of the appendix depending upon its previous position with regard to the peritoneum while within the abdomen.

This variety, then, is characterized by the presence of a single piece of large gut which is only partly covered by peritoneum (Figs. 10 and 11).

- (c) If the above condition continue to increase it will do so chiefly at the expense of the ascending colon. The mesenteric attachment of the lower part of the ileum appears to remain more or less fixed, so that the mesentery of the small gut has a relatively small attachment to the posterior wall of the sac. The ascending colon continuing to descend while the cæcum remains more or less fixed, a U-shaped

loop is formed which is composed wholly of large gut. According to Tuffier,³⁷ this condition may arise by the cæcum and colon descending to such an extent within the abdomen that the posterior surface of the colon comes to lie over the hernial orifice, and is thus the first structure to escape from the abdomen. It will be seen that the whole of this loop may be extrasaccular, or the cæcum may retain its normal relationships and thus lie within the sac covered by peritoneum, the colon alone lying without the sac.

The third type, then, is characterized by the presence of a U-shaped loop of large gut in part or wholly extrasaccular (Figs. 12 and 13).

III. *Sacless Hernia*.—This condition is very rare, and the explanation of the presence of the large intestine from the pull of a large sac would give no reason to believe that such a condition could occur. Sir F. Treves³⁵ even went so far as to state that a sac was always present. Cases, however, do undoubtedly occur in which there is no trace of a sac. One recorded by Tuffier³⁶ has already been mentioned, and Carnett⁶ records another in which complete absence of any sac was made manifest by exploratory laparotomy. The description of Tuffier given above, that the primary condition is a prolapse of the cæcum and ascending colon, gives, however, a ready explanation of the occasional presence of such a lesion.

Ransohoff²⁹ has quite recently put forward an entirely new conception as to the cause of this type of hernia. He disagrees with the belief that the condition is due to sliding of the gut and posterior layer of the peritoneum. He believes that at first there is always a complete sac, and that the gut has become bound down by secondary adhesions which are similar to the adhesions, already described, which normally take place in embryonic life between the cæcum and the peritoneum of the posterior abdominal wall. Upon the amount of adhesions depends the size of the sac; if excessive, the sac may even be

obliterated. The proofs he brings forward seem, however, to be very incomplete. He believes that the condition cannot be due to sliding, because "even in the opened abdomen it is no easy task to strip the peritoneum from the abdominal wall, so close is its adherence, a statement with which I venture to think very few surgeons would be in agreement; while his remark that "a loop of intestine found in a hernial sac is conclusive proof that originally that loop was mobile" is simply arguing in a circle. His theory cannot, I think, be accepted, for the following reasons:

- (a) It gives no explanation of the presence of the bladder in an extrasaccular position.
- (b) In accordance with his views, most cases should occur in the young, while all observers are agreed that the condition is more common over the age of 30, the few cases occurring in children being readily explained by Lockwood's views.
- (c) If his view were correct, it should be possible to make out the layer of sac behind the adherent cæcum or colon, while all are agreed that no such layer can be discerned.

Symptoms.—These are even less well defined than in the case of a hernia of the bladder; in fact, in nearly all cases the diagnosis is only made at operation. In the case of a simple hernia of the cæcum there will be nothing characteristic unless the appendix can be felt within the sac, as may sometimes happen in children. The presence of acute inflammation in such a displaced appendix has already been noted. In the other two types suspicion should always be aroused if there be a large hernia of long standing which is in part irreducible. It may be possible to distinguish it from a hernia of the bladder, apart from the presence of urinary symptoms in the latter, if the irreducible portion is noticed to lie to the outer side of the reducible part, the reverse being true in the case of the bladder. Owing to the wide neck strangulation is very rare.

At operation the same difficulties in diagnosis will arise as in the case of the bladder, but here the gut will lie posterior and to the outer side. For this reason it is very easy to open into the lumen of the gut instead of into the sac. Great care should, therefore, be exercised in actually opening the sac in all cases. As a general rule, the presence of some abnormality is made clear by the presence of a mass of fatty muscular tissue within the inguinal canal, which differs considerably from the peritoneum of the ordinary hernial sac. When once the sac is opened the condition is made clear either by the presence of a portion of large gut which is seen to be firmly adherent to the posterior wall of the sac and thus to be irreducible, or by the fact that a thick mass can be felt forming the posterior and outer wall of the upper part of the sac.

Treatment.—If there be a simple hernia, the gut can be reduced in a manner identical with that of the small gut and the sac closed in the usual way. If the gut be fixed to the sac by its mesentery or be in part extrasaccular, the operation already described will be found to answer admirably. In such cases care must be taken to separate the vas and spermatic vessels so that the testicle be not injured. In all cases sufficiently wide flaps of sac should be taken so that when folded back the gut is not constricted. When a U-shaped loop of gut is present these flaps should be specially large, so that when brought together there is no resulting angulation of the loop; and both in turning the gut forward and in suturing the flaps together, special care should be taken that the vessels supplying the gut are not injured.

The operation of re-forming a mesentery from the posterior wall of the sac was, as far as I can discover, first devised by Van Heuverswyn³⁸ in 1893, the sac being then dealt with in the usual way. A similar method has at different times been subsequently advocated by Berger,² Morris,²⁵ Tuffier,³⁷ Hotchkiss,¹³ Wier,³⁹ and Singley.³² In the method which I advocate, however, not only are the cæcum and ascending colon freed so that they can be easily reduced within the abdomen, but, the sac being firmly drawn up by the method devised by

Kocher,¹⁶ the opening is entirely obliterated and the ascending colon tends to be drawn up away from the abdominal ring.

In all cases the abdominal wall must be firmly repaired. In most cases it is sufficient to suture the conjoint tendon over the cord to the deep surface of Poupart's ligament. If, however, the wall be weak, the method of implanting two filigrees of silver wire devised by McGavin²² for this region may be made use of, or, if the hernia be direct, the method of transplanting the rectus, put forward by Bloodgood,⁴ may be tried.

Hernia of the Iliac or Pelvic Colon.—This condition may occur on either side of the body, but, as is to be expected, is more common on the left side. As in the case of the cæcum, it may be simple in nature or the gut may show close relationships to the sac wall. The former will alone be found on the right side of the body, a loop of the pelvic colon being readily able to escape into the sac of a right inguinal or femoral hernia, provided it has a sufficiently long mesentery. The true sliding hernia will be limited to the left side of the body.

Anderson¹ was the first to show that the iliac colon may have its length and bend so increased that it passes down to Poupart's ligament, along the whole length of which it may run. In this position the peritoneum, which normally only covers the iliac colon in front, may be directly reflected off the bowel onto the anterior abdominal wall so as to leave a portion of the gut uncovered by peritoneum and in direct relationship with the posterior wall of the inguinal canal. In connection with this anatomical fact, Stoney³⁴ showed that in cases of sliding hernia the gut present was more commonly the iliac colon. The presence of the pelvic colon is common in such cases, but since this portion of the gut is usually provided with a long mesentery the loop is generally unattached to the sac wall, although, as will be shown, the mesentery itself may at times be so attached.

As in the case of a hernia of the cæcum, the causes of a true sliding hernia may be congenital or acquired. The congenital, as Lockwood¹⁷ points out, will arise in one of the two ways which lead to the formation of the cæcal variety, the

attachment of the gubernaculum or testis in this case being to the iliac colon instead of to the cæcum.

In the acquired type, also, the factors at work are similar to those of the cæcum but owing to the more constant relationships of the peritoneum the methods of production are less variable. Thus there may be a preliminary prolapse of the attachments of the pelvic or iliac colon on the wall of the false pelvis, this being usually part of a general enteroptosis, or the sac may be formed in the first place and by its increase drag down the attachment of the pelvic or iliac colons until they come to lie within and arise from the wall of the sac.

The same three degrees will be recognized as in the last variety, but these degrees will be dependent not upon variations in the attachment of the peritoneum, for in this part of the gut these are much more constant, but upon the portion of the gut which happens to be in the sac. They may be considered as follows:

- (a) With a definite mesentery—in this case the portion of gut lying within the sac is the pelvic colon. Thus there is a definite mesentery to the gut, but the attachment of this mesentery to the pelvic wall is displaced so that it comes to form part of the sac wall. The mesenteric attachment of the colon must, of necessity, be more or less U-shaped, for the prolapsed gut must form a loop, there being no free projection corresponding to the cæcum (Fig. 14). Such a case was reported by Lockwood¹⁷ where the loop of gut measured two feet and was formed of pelvic colon.
- (b) In the second variety there is a single piece of large gut which is extrasaccular, this, of necessity, being formed by the iliac colon, the method of attaining this position being identical with that of the cæcum. It will be seen, however, that there must in this case also be a returning portion of gut. This will be formed of pelvic colon and will have a definite mesentery, which is attached to the

sac wall. It therefore occurs when the displacement takes place at the junction of the iliac and pelvic colons. It corresponds with the second degree of that of the cæcum, but differs from it in that it shows the returning portion attached by a mesentery (Fig. 15). Such a case has been recorded by Robinson.³⁰

- (c) In this variety there will be a loop of gut which will be extrasaccular in its whole length. It will occur, therefore, when that portion which is displaced is wholly formed of iliac colon. This was the type of case described by Stoney,³⁴ and further examples have been recorded by Robinson.³⁰ It corresponds with the third degree of that of the cæcum (Fig. 13).

It is possible that a sacless hernia might arise here also from a primary prolapse of the iliac colon, so that the posterior surface uncovered by peritoneum comes to lie over the internal inguinal ring and thus is alone prolapsed. It will be seen, however, that as the condition increased the peritoneum covering the anterior surface of the gut would also pass outward, and thus a sac would come to be formed. A true sacless hernia, therefore, could only exist in the early stages when symptoms would be slight or absent. It is probably owing to this that there appears to be no such case reported in the literature.

Symptoms.—These will be as indefinite as those of the cæcum, but, as in that case, the presence of a large hernia in part irreducible should give rise to the suspicion that such a condition is present. The presence of a large ring is also suggestive. Usually the condition is only diagnosed at operation.

Treatment.—The simple types can be easily reduced in the ordinary way. In the other types treatment will be more difficult, and Rankin²⁸ even goes so far as to state that the condition is inoperable. This, however, is far from being the case, and the method of re-forming the mesentery and sac with invagination of the latter will be found to be simple and to answer

admirably. In all cases care must be taken to thoroughly strengthen the abdominal wall by one of the methods mentioned in the case of the cæcum.

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AN INSTRUMENT FOR ESTABLISHING FECAL DRAINAGE, WITH A REPORT OF ITS USE ON A CASE, AND A CONSIDERATION OF THE SITE FOR MAKING A FECAL FISTULA IN LOW-SEATED INTESTINAL OBSTRUCTION.*

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THE parts of the instrument are shown in Fig. 1. A scale drawing of a vertical mesial section, the natural size, is given in Fig. 2.

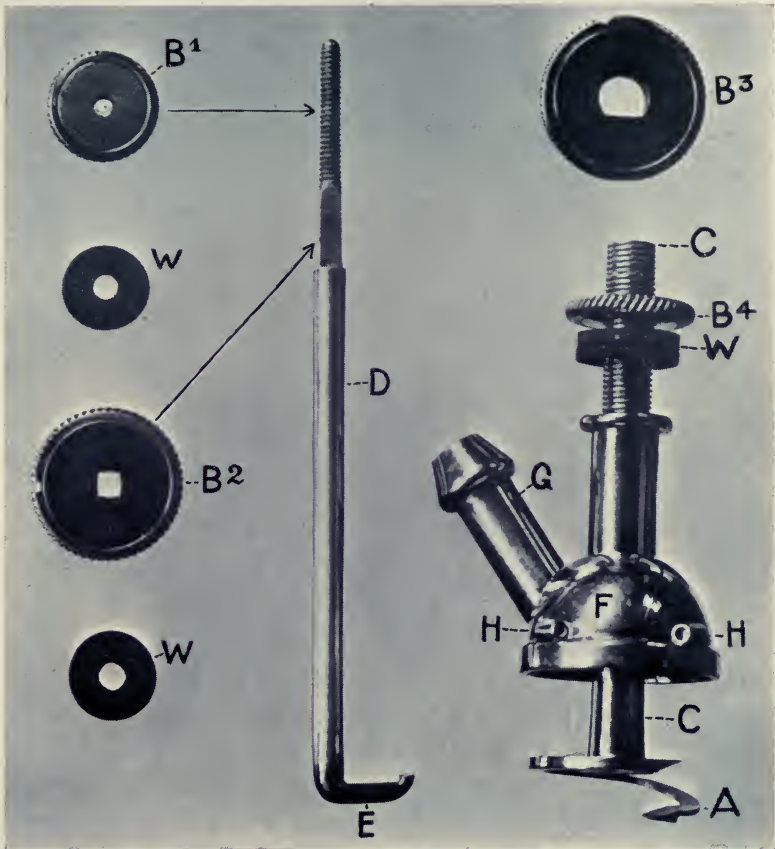
The particular use for which the instrument was designed is for the establishment of a fecal fistula, but it can also be used to allow the escape of wind from a clamped-off colon in the establishment of an artificial anus. In the latter instance it would probably be best not to make the joint connection with the bowel quite so tight as for fecal fistula, with a view of retarding the separation of the slough.

The principle employed in the construction of the instrument consists in the mechanical compression of the whole thickness of the bowel wall in a circle around a perforation in the bowel, between a ring introduced within the bowel and a cap closing over the ring from without, which maintains a water-tight joint around the perforation a sufficient length of time for protecting adhesions to take place between the bowel outside the area grasped by the instrument and the abdominal wall, before the instrument cuts through the tissues it compresses. This mechanical device does away with suture of the intestine to the abdominal wall, the bowel being held in position instead by tying the instrument grasping it, into the wound.

The instrument has been tested in five normal dogs and in

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FIG. 1.



Shows the several parts of the fistula instrument. A, as here seen, is a corkscrew spiral, connected by a binding post (P, Fig. 3 b) with a central stem C, which is hollow for the passage of the shaft D. The spiral can be transformed into a complete ring or wheel by elevating its downward-dipping extremity, which is a spring of tempered steel. The opening and shutting of this spring is regulated by the right-angled arm E of the shaft D, the revolving of which latter is effected by button 2 (B 2), which fits over a square cut portion of the shaft, and the elevation and descent of which is regulated by button (B 1), which turns on a thread. With the spring open, the arm E being set opposite the binding post (Fig. 3 a), the then spiral is passed, with a rotatory turn, within the lumen of the bowel through a small perforation, as far as to the corner where the spiral and the binding post join together, after which the perforation is made to round the corner and is then slid along the binding post onto the central stem (see legend of Fig. 5). Finally, with the manipulating apparatus outside, the spring is closed, converting the spiral into a complete ring (Fig. 3 b), against which, within the bowel, the cap F outside can then be made to evenly compress the intervening tissues, thereby forming a temporarily water-tight joint around the perforation. The cap F is screwed tightly in place by button 4 (B 4). Button 3 (B 3) is fixed to the central stem C and serves as a holder. The rubber washers W stopper the joints of the instrument and a rubber tube interrupted with a glass connection, connecting with the pipe (G) projecting from the cap, provides the outlet for the drainage from the bowel. H, H, loop-holes, of which there are four, for anchoring the instrument to the abdominal wall after it has been made to grasp the bowel.

one case of intestinal obstruction in man. The operations were all performed under general anæsthesia. In every instance adhesions formed between the bowel outside the area grasped by the instrument and the wound in the abdominal wall, with-

FIG. 2.

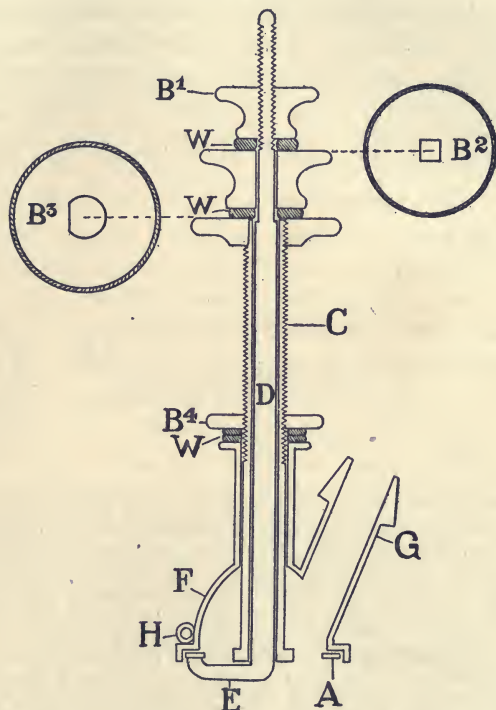


Fig. 2 (*cf.* Fig. 1) is a scale drawing, the natural size, of a vertical mesial section of the instrument. The base of the cap is $\frac{43}{48}$ inch in diameter. The bowel is compressed between the ring and the cap in two planes, one circular and one cylindrical, which meet at a right angle over the edge of the ring. The circular plane of compression lies between the upper surface of the ring and the under surface of the rim of the cap, and the cylindrical plane lies between the outer margin of the ring and the flange of the cap. Between the latter surfaces the space is $\frac{1}{64}$ inch in width, caught within which the bowel must receive an equal pressure at every point, which area of constriction, together with the right-angular bend in the bowel where the two planes of compression meet over the edge of the ring, affords the main security against leakage. While in principle the fit between the upper surface of the ring and the under surface of the rim of the cap should be an accurate one so as to evenly compress the included tissues, which adjustment is carefully tried for in the construction of the instrument, yet it would not be safe to absolutely rely upon this one plane of compression alone to effect the water-tight joint, since, owing to the flexibility of the spring, it is a little difficult, with the shutting of the latter, to get every point on the upper surface of the resulting ring to lie in one and the same plane. The lettering corresponds to that of Fig. 1.

out any infection of the peritoneal cavity. In the first animal experimented upon no drainage material was introduced into the wound, and, as a result, a severe phlegmon of the abdominal wall developed, from which apparently the animal died. After

this, the placing of a gauze collar around the base of the instrument (Figs. 6 and 7) was introduced into the technic of the operation, and then no sepsis occurred.

In the first three dogs and in the patient the abdominal incision was a transrectus one, and the loop-holes of the cap were tied to the margins of the cut in the anterior layer of the rectus sheath. In the last two dogs the incision was transverse, dividing the linea semilunaris and the abdominal wall external thereto, the loop-holes of the cap were tied to the outer surface of the external oblique muscle at points about 1 cm. from its

FIG. 3a.

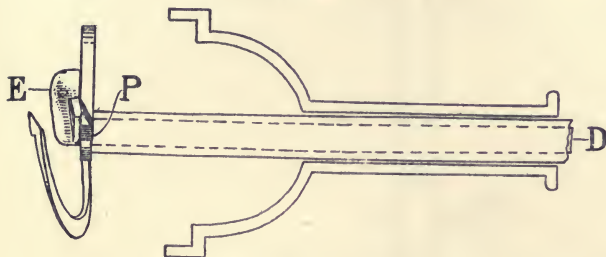


FIG. 3b.

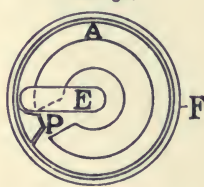


Fig. 3 a shows the adjustment of the instrument preparatory to use. The cap is slid up on the stem. The spring is open and the right-angled arm *E* of the shaft *D* is set opposite the binding post *P*, where it is secured firmly in position by turning up tight button 1 (Figs. 1 and 2). Buttons 2 and 3 are properly notched, so that when the two notches lie opposite each other the arm *E* underlies the binding post. The instrument, during the introduction of the spiral, should be held with its long axis approaching the horizontal position (*cf.* Fig. 5).

Fig. 3 b, drawn to a scale the natural size, shows the base of the instrument with the spring closed, the spiral thus having been converted into the ring, which closure should be made after the complete passage of the spiral through the perforation to within the lumen of the bowel. To effect closure of the open spring, the right-angled arm *E* of the central shaft, after having been loosened from its position of fixation described under Fig. 3 a, is rotated by turning button 2 (Figs. 1 and 2) from left to right, until it encounters the notch near the tip of the spring, and then, by screwing button 1 up tightly, the spring is raised into the position of completing the circle. If the rubber washer beneath button 1 is dry it will oppose great friction to turning this button as the grip of the latter tightens. The friction can be overcome by a drop of oil.

cut edges, and the deep portion of the muscular opening was narrowed around the extruded bowel, as recommended herewith. In the fourth dog, while under ether just before being killed two days after the operation, it was found that the muscle-fibres of the abdominal wall maintained a loose closure of the fistulous opening. The finger inserted through the fistula was felt to dilate slightly the opening in the abdominal wall, and, as it was withdrawn, a lot of fluid escaped from the intestine, which before had apparently been retained by a sphincter-like action of the encircling muscle fibres. The specimen pictured in Fig. 7 was from the fifth dog.

THE CASE.—The patient, a male, weighing about 225 pounds, was admitted to St. Vincent's Hospital on September 20, 1911, to the service of Dr. Edward L. Keyes, Jr., having fallen 30 feet and sustained an injury to the pelvis. On the fourth day a fecal fistula for the relief of intestinal obstruction was established as follows: Chloroform and oxygen anæsthesia was administered by Dr. Gwathmey. The incision was made through the outer fibres of the right rectus muscle, the skin cut beginning at the level of the umbilicus and extending downward about $3\frac{1}{2}$ inches, while the opening through the abdominal wall, placed centrally within the skin cut, was about 1 inch in length. The presenting piece of bowel could not be displaced and an adjoining loop substituted for it, so fixed in their positions were the distended coils. It had been planned at this juncture to include a sufficient area of a distended piece of bowel within the grasp of two curved intestinal clamps having thin spring blades protected with rubber, and draw it outside the abdominal wall while the fistula connecting-joint was being adjusted in position, but this was found impossible to carry out owing to the shortness of the mesenteric tether, which barely allowed the gut to be drawn sufficiently far into the abdominal wound to work on. The two intestinal clamps were at the start applied to the presenting piece of bowel, but the included area was so small that one clamp had to be removed. There was some little escape of gas during the introduction of the spiral, but there was a much greater escape of gas through the tube attached to the fistula connecting-joint after the latter was in place. There was not sufficient room in this wound to introduce gauze for the protection of the peritoneal cavity, but there was essentially no escape of intestinal contents. The cap was screwed down as firmly as possible against the ring, thus compressing the bowel around the perforation. Silkworm-gut sutures were inserted to attach the four loop-holes of the cap to the edges of the cut in the anterior portion of the rectus sheath, before tying which a narrow collar of iodoform gauze was placed beneath them around the line of juncture of the instrument with the bowel, for drainage. After tying the silkworm-gut sutures the ends were left long, protruding through the wound, so that they could easily be found for subsequent removal, and the wound was then filled with iodoform gauze.

Subsequent Course.—There was immediate and complete re-

lief to the distention. The patient lived 22 hours following the operation. About 15 hours after the operation about 1 pint of intestinal contents dropped freely from the tube, at which time it was noted that the abdomen had become considerably distended again. Eighteen hours after the operation the patient was fully distended again and vomiting. The instrument was then evidently obstructed, as fluid could not be forced back through the rubber tube into the intestine. The rubber tube was cut off 2 or 3 inches from the instrument and then, by the injection of olive oil and probing with a paracentesis tympani knife, the obstruction at the site of the fistula was apparently overcome. The pieces of the tube were joined together again by a glass connection. Small quantities of fluid injected through the tube would return, yet practically no gas escaped any longer, to test which latter the free end of the drainage tube was put under water.

Post Mortem.—Within the circle of compression there was a slough which had not cut through, so that no intestinal leakage had occurred into the abdominal wound. There was a firm adhesion of the bowel around the fistulous opening to the abdominal wall. There was no peritonitis. The iodoform gauze collar was firmly adherent. On one side the collar had gotten pushed well down alongside the bowel, so that it prevented so extensive an adhesion to the abdominal wall on this side as was present on the other. A little more than half the lumen of the bowel was taken up by the fistula and its peripheral adhesions. The instrument used, however, was an early model, having a cap the base of which measured one inch in diameter. The site in the bowel where the fistula was made was found to be about 12 feet from the ileocaecal valve. The lower ileum was found to occupy the region in front of the ascending colon. The sigmoid flexure dipped horseshoe-shaped from two sites of fixation at the brim down into the pelvic cavity, which it filled so snugly that it was pulled out with the overcoming of considerable suction. An angulation here seemed to have been the cause of the obstruction. The pelvic cavity was very much narrowed with fat, and the sigmoid loop was fatty. There was a diastasis of the pubic bones of about $2\frac{1}{2}$ inches, and the soft parts were stripped from these bones both in front and behind. In the cavity that had formed at this situation there was collected about 6 to 8 ounces of bloody fluid. There was no infiltration around either kidney.

Other Notes from History.—A catheter tied in the patient's bladder on admission had, at the beginning, drained a few ounces of bloody urine, and then anuria supervened. Later a small quantity of urine could be withdrawn. On the fourth day a perineal and scrotal extravasation of urine developed, which subsided with incision. During the third and fourth days the temperature had been around $98\frac{1}{2}^{\circ}$ most of the time.

Observations.—It is of interest that an apparently correctly made fecal fistula which had been patulous for at least 15 hours, had not, after the primary relief, been affording adequate drainage of the bowel, since at the expiration of this time distention had begun to recur; and also that after another three hours, when an obstruction which had in the meantime occurred at the site of the fistula was relieved, no further escape of gas took place. In trying to account for this result it has seemed possible that an angulation of the bowel might have occurred at the site of fistula formation, or, in view of the fact that the fistulous opening was situated about 12 feet along the gut above the ileocæcal valve, it might be explained on physiological grounds, that, in order to get effectual drainage of a distended small intestine, it may be necessary to tap the latter near the ileocæcal valve. Moynihan¹ calls attention to the fact that "fluid taken by the mouth speedily excites a wave of peristaltic activity in the lowest ileum." He continues, "In cases of typhlotomy or of enterostomy, in which the cæcum or lowest ileum is opened, it can constantly be observed that the drinking of a little fluid excites a considerable disturbance in this region." For the latter reason, as well as in the interest of establishing the fistula at a situation which would allow the best nourishment of the patient, a study was made on the cadaver to determine an incision through the abdominal wall which would with greatest invariability expose a piece of gut in the ileocæcal region in the presence of low-seated intestinal obstruction.

The physical conditions attendant upon intestinal obstruction are so vastly different from the normal that a proper technic of joining the fistula instrument with the intestine in

¹ Moynihan: *Acute Emergencies of Abdominal Disease*, Brit. Med. Journ., April 1, 1911.

the obstructed condition had also to be made the subject of special study. The complicating circumstance in connecting the fistula instrument with the bowel in a case of intestinal obstruction is, that in great abdominal distention the intestines next the abdominal wall in the lower right quadrant of the peritoneal cavity generally lie at the limit of their mesenteric tether, so that the piece of bowel presenting at a wound in the abdominal wall within this area cannot be drawn outside of the peritoneal cavity for manipulation. Slack in the bowel can be gained only by getting the abdominal wall to retract, and this, in turn, can be attained only by the elimination of gas from the distended intestines; so that the primary problem resolves itself into how to allow the escape of gas from a piece of distended intestine presenting in a small abdominal incision, which is immobilized flush with the parietal peritoneum both by a general intestinal distention and a limiting mesenteric attachment, without soiling the peritoneal cavity with intestinal contents.

These problems, as well as a proper technic of fixing the fistula instrument in the wound in the abdominal wall, were studied on cadavers.

CADAVER STUDIES FOR THE DETERMINATION OF AN ABDOMINAL INCISION WHICH WOULD WITH GREATEST INVARIABILITY EXPOSE A PIECE OF DISTENDED GUT IN NEAR CONTINUITY WITH THE ILEOCÆCAL VALVE, IN THE PRESENCE OF LOW-SEATED INTESTINAL OBSTRUCTION.

Observations were made on 19 bodies. *Since in the patient the lower ileum had occupied exclusively the right flank*, lying in front of the ascending colon, the course taken by the ileum from the ileocæcal valve was made a record of in each body. For the determining of the abdominal incision it was necessary to inflate the intestines. Two conditions of distention were studied: one, that in which the cæcum took part in the general distention, and the other, that in which the cæcum was collapsed and small intestine only was distended. To study the former condition, the inflation was generally made through the transverse colon, while to study the latter the lower ileum was tied off and the inflation made through a piece of small intestine picked up from the left side of the pelvis.

Two right-sided incisions in particular were made the object of study. Both were transverse, one opposite the junction of the outer with the middle thirds of Poupart's ligament, and the other opposite the most

prominent portion of the anterior superior spine of the ilium. Both cut through the internal oblique and transversalis muscles in the course of their fibres. The midpoint of the former was about $1\frac{1}{2}$ inches internal to Poupart's ligament, making an opening through which the most direct access to the lateral portion of the pelvic brim can be had. This incision generally lies below the level of a distended cæcum.

The higher incision first cuts the abdominal wall just external to the linea semilunaris and then cuts through the linea semilunaris, making an opening about $1\frac{1}{2}$ inches in length (Fig. 4). The linea semilunaris in the course of this incision generally corresponds to a point midway between the anterior superior spine of the ilium and the middle line of the abdomen. Its division allows the wound to gape to a considerably additional extent, and affords as well, to the exploring finger, an added reach in the direction of the brim and promontory. The inner extremity of this incision, in both distention and collapse of the abdomen, lies directly over the bony angle at the right side of the promontory, thus indicating a very direct route to the region of the ileocæcal valve and to the site of lowest attachment of the mesenteric root. This incision exposes a distended cæcum, unless the latter be situated abnormally high.

In the series of observations on the 19 cadavers, only those records of individual cases which it was thought might contribute information of interest to the subject are here given. In 13 of the cadavers the intestines were inflated. The first three of these inflation tests were made on opened bellies to seek for variability in the position of the lower ileum in the presence of general intestinal distention. Ten inflation tests were made on closed bellies for the study of abdominal incisions in relation to the presenting pieces of distended intestine. From the latter studies it was determined that a distended cæcum would generally present in the higher of the two transverse incisions, but not in the lower. Of particular practical interest in this series were the observations made in the presence of inflated small intestines alone, the colon being collapsed (subjects *d*, *e*, *f*, *g*, and *h*). In six of the cadavers, simply the location of the lower ileum within the peritoneal cavity was noted, without inflation.

The following three cases are those on which the inflation tests were made on opened bellies the intestines of which had undergone previous manipulation:

(*a*). Thin male. Pelvis roomy. The lower ileum was first deposited in the pelvic cavity, and then the intestines were inflated through the sigmoid flexure. With the inflation, the lower ileum rose out of the pelvis and took a position in the right flank to the inner side of the cæcum and in front of the ascending colon, while some of the mid-loops of small intestine slid down into the pelvic cavity to take its place. The lowest loop of ileum that lay in the pelvic cavity was about 8 feet above the ileocæcal valve. It was estimated that a loop of ileum about $2\frac{1}{2}$ feet above the ileocæcal valve about corresponded to a mid-point between the 10th costal cartilage and the anterior superior spine of the ilium.

(*b*). Fat male. Pelvis roomy. From the ileocæcal valve the ileum passed directly into the pelvic cavity. The 4 inches of ileum adjoining the ileocæcal valve were bound firmly down across the psoas muscle.

Intestines distended through transverse colon. A loop of small intestine lying in front of the distended cæcum, about corresponding to the site of the incision in the patient, was about 7 feet above the ileocæcal valve. A loop picked up just above the pubis a little to the right of the median line had about 3 feet of intestine intervening between it and the ileocæcal valve.

(c). Thin male. Pelvis roomy. The ileum descended from the ileocæcal valve into the pelvic cavity. Its four inches nearest the cæcum were attached by a very short mesentery, which allowed this segment very little mobility. The cæcum was free and distended tremendously. The loop of ileum lying just internal to the distended cæcum, opposite the ileocæcal valve, had about 4 feet of intestine intervening between it and the latter.

The following observations on the relations of the two transverse abdominal incisions to the distended small intestines were made. In cadavers *g* and *h* the relations of the distended bowel to the lower transverse incision were not recorded. It is distinctly remembered, however, that in these bodies the lower incision offered no advantage over the upper, and all the preference was in favor of the latter. In cadaver *i* both large and small gut were inflated.

(d). With the lowest ileum, which here passed from the ileocæcal valve directly down into the pelvic cavity, tied in its terminal portion, and the small intestine inflated, the loop that presented in the transverse incision opposite the anterior superior iliac spine was about 2 feet from the ileocæcal valve.

(e). The lowest $1\frac{1}{2}$ feet of ileum had a short mesentery and lay in the right iliac fossa below a high-seated cæcum. The next higher piece of ileum formed a loop dipping into the pelvic cavity and then ascended into the right flank. The ileum was tied about $1\frac{1}{2}$ feet from the ileocæcal valve, and, after inflation, the piece of small intestine that presented in the transverse incision opposite the anterior superior iliac spine was about 1 foot above the site of ligature. In the transverse incision opposite the junction of the outer with the middle thirds of Poupart's ligament, the loop that presented was continuous with that found in the upper incision.

(f). The ileum was tied very near the ileocæcal valve. With inflation of the small intestines, two pieces of distended gut presented in the transverse wound opposite the anterior superior iliac spine, the internal of which was about 5 inches and the external of which was about 15 inches from the seat of ligature of the ileum. The external of these pieces was directly continuous with the piece of bowel that presented in the transverse wound opposite the junction of the outer with the middle thirds of Poupart's ligament. A third piece of distended gut lying in the iliac fossa external to the abdominal incisions was about $4\frac{1}{2}$ feet above the seat of ligature, showing that the piece of intestine farthest to the right in the pelvis is not necessarily the piece in closest continuity with the ileocæcal valve. In distention the lowest ileum passed over the brim to the right of the promontory, and then went diagonally across the pelvis to the left, lying superficial to the mesenteric root descending from above the promontory into the pelvic cavity. In this cadaver the distention held very tight and afforded an excellent opportunity to palpate the mesentery. The finger

took a direct route between the two presenting coils down to the brim, and, following the latter inward, could palpate a transverse mesentery, here tense, attached between the spinal column and the ileocæcal valve, which was associated with the piece of gut presenting at the inner part of the wound, distinguishing the same as being near the ileocæcal valve.

(g). Before inflation the lower ileum was situated entirely above the brim. The ileum was tied about 6 inches above the ileocæcal valve. With inflation the lowest ileum descended into the pelvic cavity, forming a short loop over the brim. Two distended pieces of bowel presented about equally in the upper and lower halves of the transverse incision opposite the anterior superior iliac spine. The finger could be insinuated between these two coils directly to the brim, palpation along which toward the promontory distinguished a transverse mesenteric attachment between the spinal column and the ileocæcal valve in near association with the lower presenting piece of bowel, which would seem to indicate nearness of such piece of bowel to the ileocæcal valve, as was here found to be the case. The lower piece of presenting bowel was found to be about 10 inches and the upper piece about 3 feet from the ileocæcal valve.

(h). The lowest ileum passed into the pelvic cavity. It was tied about 4 inches from the ileocæcal valve and the small intestines were inflated. The lower $4\frac{1}{2}$ feet of the ileum were found collapsed in the right side of the pelvic cavity and the first inflated loop adjoining the collapsed portion rose directly out of the pelvic cavity and presented in the transverse wound opposite the anterior superior iliac spine. The presenting piece of intestine was about 1 foot above the collapsed portion.

(i). Very fat female. Before inflating the intestine it was observed that the lowest 3 feet of ileum formed a loop upward into the region of the cæcum and ascending colon. The next higher portion of the ileum occupied the lower right iliac region and pelvic cavity. Distention effected through colon. At the inner angle of the transverse wound opposite the anterior superior iliac spine, there presented alongside the distended cæcum a piece of small intestine which was about 5 feet above the ileocæcal valve.

Variations in the Anatomic Arrangement of the Lower Ileum.—Out of the 19 cadavers studied, the distended lower ileum occupied exclusively the right flank in one instance (subject *a*). The conditions in this cadaver, however, were not exactly similar to those existing in the patient, since in the former the belly had been widely opened before inflation, yet, since the arrangement of the coils in distention is probably influenced chiefly by the conformation of the mesentery, it would seem fair to include both these subjects in the same class. Once (subject *i*) the lowest 3 feet of ileum formed a loop, ascending into the region of the cæcum and ascending colon before the bowel descended into the pelvic cavity, and again the lowest 1 foot of ileum did the same. In three instances

(including subject *e*) the ileum passing from the ileocæcal valve formed a loop in the right iliac fossa before descending into the pelvic cavity. In two instances (including subject *f*) the lowest ileum passed from the ileocæcal valve diagonally across the pelvis downward and to the left above the brim, while the loops farthest to the right in the iliac fossæ were respectively about $4\frac{1}{2}$ and (probably) about 7 feet above their ileocæcal valves. In eleven instances the lowest ileum passed over the brim directly into the pelvic cavity.

The Immobility of Distended Intestines.—In the intestinal distention produced on the cadavers, the loops of small intestine in the right iliac region were generally found in contact with the parietal peritoneum at the limit of their mesenteric tether, so that the presenting piece of gut could not be drawn outside of the peritoneal cavity, and were so tightly wedged together that the loop presenting in the wound could not be displaced and an adjoining one substituted for it. With the finger the mesentery could be felt to be taut, and it seemed as though a considerable traction on the same must be an accompaniment of great abdominal distention.

Palpation of the Mesenteric Attachments through the Incision Opposite the Anterior Superior Iliac Spine.—In the case of a distended cæcum, palpation within the peritoneal cavity is of use only in determining whether this piece of bowel be free or attached. With, however, the colon collapsed and small intestine presenting in the wound, it would be helpful if by palpation an estimate of the probable length of bowel intervening between the presenting piece of intestine and the ileocæcal valve could be formed. The writer would propose the *pelvic brim* as the location first to be sought for by the exploring finger. Here a piece of lower ileum passing from the neighborhood of the ileocæcal valve into the pelvic cavity, usually at a site just to the right of the promontory, can be detected, or, when this piece of bowel rather lies forward in the pelvic cavity, it may be identified by pushing the finger upward from the brim and feeling its mesentery attached transversely between the spinal column and the ileocæcal valve. In order to reach the brim the finger must pass beneath, or

external to, any intervening mesentery. In cases where the lowest ileum descends into the pelvic cavity, when the finger can be passed external to the presenting piece of bowel in a very direct line to the brim, that piece of bowel is likely in near continuity with the ileocæcal valve (*cf.* subject *f*). In palpating, the greatest reach in an inward direction can be gotten by the middle finger with hand supine.

The advantages of the transverse incision opposite the anterior superior iliac spine, as a primary choice, over that opposite the junction of the outer and middle thirds of Poupart's ligament.

1. If the obstruction is in the large intestine, the former incision will expose the distended cæcum, unless the latter be situated abnormally high.

2. With small intestines alone distended after tying the terminal portion of the ileum in 4 cadavers, the pieces of bowel nearest the ileocæcal valve which presented in the higher incision were, respectively, 2 feet, 1 foot, 5 inches, and 4 inches (subjects *d*, *e*, *f*, and *g*) above the seat of ligature. These observations indicate but a general tendency for a very low piece of distended ileum to be in relation with the higher incision (*cf.* subjects *a*, *b*, *h*, and *i*).

3. The higher incision is nearer the lowest site of attachment of the mesenteric root to the posterior parietes, so that the mesenteric tether of a piece of ileum presenting in this wound would be much more liable to allow a greater amount of extrusion of its attached bowel upon relief of the distention than would the mesentery of a piece of bowel presenting in the lower incision.

4. Palpation of the mesenteric attachments is more direct through the higher incision.

PROPOSED TECHNIC OF ESTABLISHING A FECAL FISTULA FOR
THE RELIEF OF A LOW-SEATED INTESTINAL OBSTRUCTION
WITH THE USE OF THE FISTULA CONNECTING-JOINT.

Since the technic of establishing a fecal fistula for the relief of intestinal obstruction as here proposed has had to

be based largely upon cadaver study, though carefully planned in accordance with surgical principles, it must yet receive the test of experience before it can be thoroughly approved. It can, however, be said in its favor that, with the use of this mechanical device which makes in a few minutes a water-tight drainage connection with the bowel around a small puncture, with no intestinal suturing, the operation would surely seem to be attended with much less danger of infecting the peritoneal cavity than has attended previous methods, that the operation can be more easily and rapidly performed than with any other technic, and that, with no added danger, relief from the intra-abdominal tension is gained at once.

The general technic of the operation as here proposed is indicated in the legends of Figs. 3, 4, 5, and 6, while Fig. 7 pictures the result attained by the operation performed on a normal dog. The following discussion of the technic of the operation amplifies the legends.

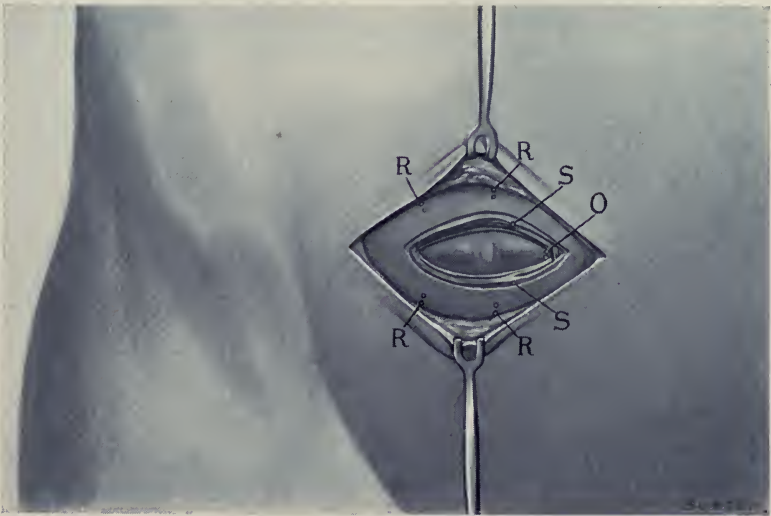
The Holding-thread.—The principle of the holding-thread placed close to the site of puncture of the bowel, as a means of preventing soiling from intestinal contents, has been utilized by Coffey² in connection with opening the stomach. Coffey raises forward by holding-threads an anterior area of stomach wall for incision, thus causing the opposite portion to pouch dependently for the collection of the stomach contents, which are removed by means of a ladle and gauze wiping. In like manner here, the raising forward of the site of puncture should distance it from the level of the gravitated intestinal contents, thus allowing the escape of gas with a minimum of ooze.

The holding-thread must be securely placed beyond any possibility of its tearing out, and therefore it would seem best that the needle placing it should pass through the interior of the bowel, making, of course, sure that this site of puncture be later included within the area encompassed by the compressing circle of the instrument.

The holding-thread should likewise catch the presenting

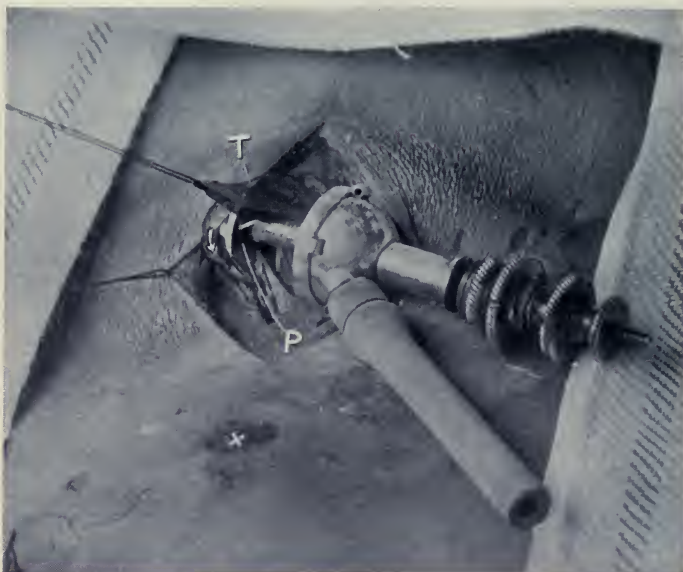
² Coffey: Jour. Amer. Med. Assn., lvii, 1911, p. 1034.

FIG. 4.



Proposed incision of primary choice for the establishment of a fecal fistula in low-seated intestinal obstruction (see pp. 113 and 119). The incision is one across the right iliac fossa at a situation which will generally uncover a distended cæcum, or, if the obstruction is at or near the ileocæcal valve, most probably a low loop of distended ileum. It is made in the transverse line between the anterior superior spines of the ilia and cuts through the abdominal wall on the right side, first just external to the linea semilunaris and then through the linea semilunaris, making an opening in the abdominal wall about $1\frac{1}{2}$ inches in length. The division of the linea semilunaris allows the wound to gape, thus making as broad as possible an exposure of the bowel. The inner portion of this incision is situated directly over the bony angle of the brim at the right of the promontory, lies in front of the normally situated ileocæcal valve, and is in near relation with the site of lowest attachment of the mesenteric root. The dots indicate the sites for the sutures seen *in situ* in Fig. 6. O, site, at the inner angle of the wound, of introducing the holding suture in a presenting distended cæcum bound down in the external portion of the iliac fossa, which admits of the greatest amount of slack being drawn out of the peritoneal cavity centrally into the wound (see p. 119). With the cæcum bound down in the iliac fossa no slack bowel can be drawn inward from the outer angle of the wound, so that the holding stitch should then not catch the bowel at the latter situation. R, R, R, R, sites for the four silk worm-gut sutures anchoring the fistula instrument to the aponeurosis of the external oblique muscle, about 1 cm. from the edges of the cut. S, S, site of passing a catgut suture through the internal oblique and transversalis muscles and the parietal peritoneum, to narrow this deep portion of the abdominal wound around the extruded bowel beneath the portion grasped by the instrument.

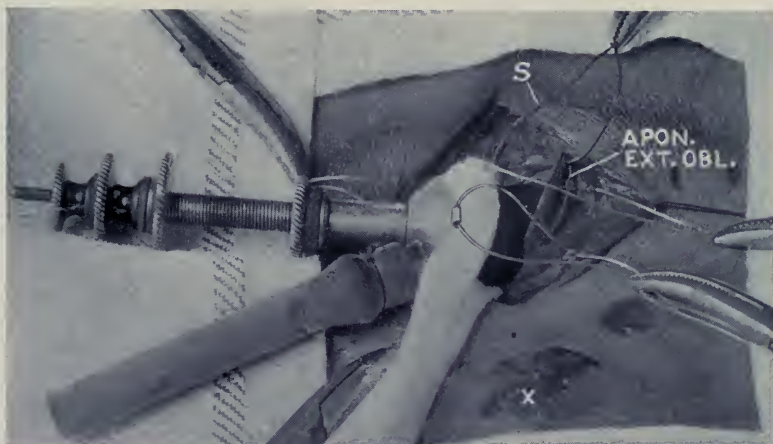
FIG. 5.



Fixation of the instrument in the bowel (planned from cadaver study) (see p. 119). A gauze strip should, if possible, be placed so as to protect the peritoneal cavity from infection. A holding-thread is first made to catch deeply the presenting piece of bowel at a site which permits of slack being drawn into the wound (see p. 118), and thereafter is held taut. A small opening about $\frac{1}{4}$ inch in diameter is cut in the bowel near the thread. On the cadaver, with puncture of the bowel gas is eliminated sufficiently to cause enough retraction of the abdominal wall so that the piece of bowel caught by the holding-thread can be drawn into the wound in a tent-like fold, which is the position of choice for the introduction of the spiral. With the instrument adjusted (Fig. 3 a) for introduction of the spiral, the latter is now inserted through the opening by a corkscrew turn in the direction of the cleft between the slopes of the tent-like fold. Thus during this manipulation the shaft of the instrument approaches the horizontal position. In order that the free extremity of the spiral shall not catch on the bowel during its introduction, the rim of the introduced portion should be first pushed into the bowel in a direction away from the operator, following the bowel wall, and then sunk backward within the lumen of the gut. *T*, contour caused by the contact of the rim of the introduced portion with the interior of the bowel.

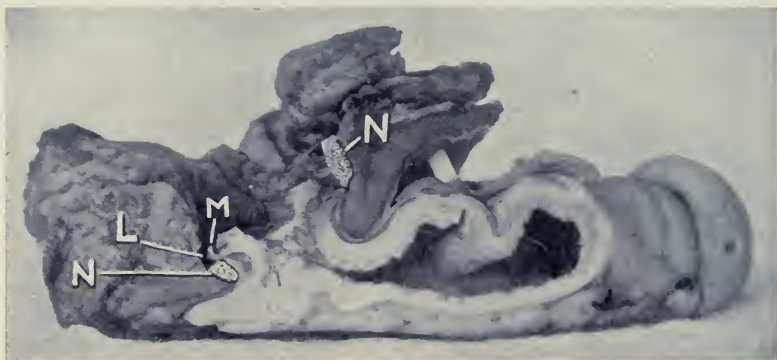
When the spiral has been introduced up to the post (*P*) which binds it to the central stem, then the opening in the bowel is made to turn the corner and pass over the binding post onto the central stem, by pulling on the tissues which tend to gather at this situation into an obstructing fold, in the direction of the arrow (see p. 120). As the perforation in the gut rounds the corner the instrument is raised into the vertical position, and, holding the bowel with the thread, the binding post is pushed within its lumen until the perforation encircles the central stem. The spring is now closed (Fig. 3 b), the holding-thread is cut away, the instrument now serving as tractor, and the cap is brought down over the ring within the bowel so as to include the punctured areas, and screwed firmly in place. *X* on anterior superior spine of ilium.

FIG. 6.



Plan of fixation of the bowel in the transverse abdominal wound here recommended (cf. Fig. 4 and see p. 121). No intestinal sutures are used. Instead, after the instrument has been made to grasp the bowel, the four loop-holes around the margin of the base of the cap are bound by silkworm-gut sutures, two on either side of the wound, to the aponeurosis of the external oblique muscle at points about 1 cm. from its cut edges. Before tying any of these sutures a collar of $\frac{1}{4}$ -inch-wide folded iodoform gauze should be passed beneath them so as to encircle the base of the cap. Without a drain of this sort in the first dog test of the instrument, a severe phlegmon of the abdominal wall resulted. Each two sutures fixing the instrument to the same side of the wound should grasp the aponeurosis at points a sufficient distance apart, so that when they are tied, the intervening aponeurosis will not be drawn snugly against the base of the cap, since, if the latter is done, the gauze drain is then depressed between the bowel and the abdominal wall, thus diminishing the extent of the adhesion in this situation (see Fig. 7). Also before tying these fixation sutures, a catgut stitch *S*, grasping the internal oblique and transversalis muscles and the parietal peritoneum on either side of the wound, narrows the latter around the extruded portion of the gut to a diameter less than that of the base of the cap. A collar of deep tissue of the abdominal wall is thus brought snugly and securely around the gut for adhesion, throwing the area for fistula formation well outside of the peritoneal cavity. A second catgut stitch is inserted if necessary for closure of the peritoneal opening. The ends of the silkworm-gut sutures are left long to facilitate the subsequent removal of the sutures. *X* on anterior superior spine of the ilium.

FIG. 7.



Cross section of a dog specimen of a fecal fistula established by the use of the fistula instrument, removed 22 hours after operation, and hardened before the instrument was cut free. The area included within the circle of compression had sloughed out. The notch *L* had received the flange (Fig. 2), turned at a right angle around the margin of the base of the cap. The thin edge of tissue *M* forming the inner boundary of this notch corresponds to the site of separation of the slough at the outer limit of the circle of compression. The incision was a transverse one at the outer border of the right rectus muscle, cutting the linea semilunaris. The four loop-holes around the base of the cap, after the instrument had been made to grasp the bowel, had been anchored to the outer surface of the external oblique muscle on either side of the wound about 1 cm. from its cut edges, so that the bowel was drawn well into the abdominal wound. The wound through the internal oblique and transversalis muscles and the parietal peritoneum was at the same time narrowed rather closely around the protruded bowel, so that this deeper portion of the abdominal wound is seen to have underlapped the base of the instrument, thus causing the bowel to flare a little outside of the level of narrowing. Within the peritoneal cavity the bowel has also flared a little around the opening, so that an adhesion has taken place as well between peritoneal surfaces. The portion of the gauze drain *N* on the left side of the illustration is seen to lie between the bowel and the abdominal wall below the level of the compressing circle of the instrument, thus diminishing the extent of the adhesion in this situation. The deep position of the drain on this side was due to the catching of the external oblique by the two fixation stitches of this side at points situated so closely together that there was no space for the gauze collar to ride up between them alongside of the instrument.

piece of bowel at a situation which will admit of the greatest possible amount of slack being drawn out of the peritoneal cavity centrally into the wound, so that, with the relief of intra-abdominal tension resulting from puncture of the bowel, the holding-stitch can both draw the site of puncture up to as great a height as possible outside of the peritoneal cavity, and at the same time form the tent-like fold (Fig. 5) which accommodates the manipulations of installing the fistula instrument in place. In the case of a distended cæcum fixed to the outer portion of the iliac fossa, the greatest amount of slack can be secured by catching this bowel with the holding-thread at the inner angle of the transverse abdominal wound (Fig. 4, O), since internally a cæcum thus attached is free and such holding-thread can, therefore, be made to pull its site of fixation in the bowel in an outward direction. On the other hand, a holding-thread catching such bowel at the outer angle of the wound would be unable to draw any slack inward, owing to the attachment of the intestine externally in the iliac fossa. In one cadaver, in which the lower extremity of a perfectly free cæcum, in the presence of general intestinal distention, reached no further downward than to protrude into the transverse wound opposite the anterior superior spine of the ilium, then but little slack could be drawn from any one direction, yet a little more could be drawn from above than from either side, and it was found that the greatest amount of slack could be pulled out of the peritoneal cavity by placing the holding-stitch in the presenting cæcum at a site corresponding to the middle of the incision through the abdominal wall, and pulling on it in a downward and forward direction. With this fixation of the bowel the further technic of adjusting the instrument was carried out in accordance with the regular plan.

Fixation of the Instrument in the Bowel (Fig. 5).—The success in introducing the spiral (*A*, Fig. 1) within the bowel depends upon the ability to keep the extremity of the spring free from catching on a fold of bowel. The position of the gut most favorable for the introduction of the spiral through the perforation is the tent-like fold brought into being by

traction on the holding-thread after puncture of the bowel has been made. With the shaft of the instrument held perpendicularly to a plane passing between the two slopes of this tent-like fold of bowel, the extremity of the spiral is made to enter the puncture and to then turn into the lumen of the bowel between the layers of the fold, which latter it can be made to escape until it has nearly made the complete turn and comes up into the top of the tent.

To keep the extremity free during this manipulation, the rim of the introduced portion must first be pushed away from the operator against the bowel surface on the further side of the holding-thread (Fig. 5, *T*), and later, as the introduction progresses, with this site of contact of the rim with the bowel maintained, the extremity is made to sink posteriorly into the bowel cavity. When the extremity reaches the top of the tent-like fold, it catches on the mucous membrane and just afterward the perforation comes up against the binding post (Fig. 5, *P*), thus causing a gathering of the bowel at the opening of the spring. This gathering makes it impossible to draw the perforation in the bowel around the corner where the spiral joins the binding post by further pulling on the holding-thread. The obstructing fold can, however, be liberated by traction on the bowel just proximal to the perforation in a direction toward the operator (Fig. 5, *arrow*), which first pulls the gathering out flat, thus clearing the extremity of the spring, and then, continued in the same direction, readily draws the opening in the gut around the corner of the instrument.

In introducing the point of the spiral through a puncture in a thick piece of gut, as the sigmoid flexure in the making of an artificial anus, it may be necessary to grasp with forceps and evert the aperture in the mucous membrane.

When the cap is screwed down into place, compressing the bowel against the ring, the axis of the metal pipe (Fig. 2, *G*) leading from the cap should be out of the line of the binding post (*P*) and the arm *E* (Fig. 3 *b*), so that if it be found necessary to clear the drainage channel by passing a fine probing instrument through the metal pipe into the bowel, such instrument will not meet with the obstruction of these cross-lying

metal parts. A glass tube connection should be made to interrupt the continuity of the rubber drainage tube near the instrument.

Fixation of the Fistula Instrument to the Abdominal Wall. The technic of fixation of the fistula connecting-joint grasping the bowel, to the abdominal wall, described in the legends of Figs. 4, 6, and 7, seems to be a correct one for the transverse abdominal incision here recommended. At the site of this incision the structure of the abdominal wall is very thin at the linea semilunaris, external to which it gradually increases in thickness, so that the fixing of the cap (diameter of base $43/48$ inch) of the instrument in this situation to the front of the aponeurosis of the external oblique 1 cm. from its cut edges, and the drawing of the deeper structures of the abdominal wall in a collar around the intestine beneath the base of the instrument, seemed always capable of accomplishment without compromising too much of the lumen of the bowel. In a thick part of the abdominal wall, however, the instrument should probably rather be anchored to the edges of the superficial portion of the wall structure. In the patient, with the latter technic, and using an instrument having a base one inch in diameter, a little more than half the lumen of the bowel was taken up in a transrectus wound.

The ends of the silkworm-gut stitches anchoring the instrument in the wound should be left long to facilitate removal of the stitches. The gauze collar at the junction of the instrument with the bowel should be drawn well up against the base of the instrument after the fixation stitches have been tied. The superficial wound should be packed loosely with gauze.

The Removal of the Fistula Instrument.—In the fifth dog the instrument had cut through the bowel within 22 hours. The adhesions around the fistula in this animal (Fig. 7) were very strong, as also were those in the patient, who had lived an equal length of time following the operation. Unless the ends of the fixation stitches be left long, it is difficult to find and cut loose these stitches. The gauze collar should be left in the wound, to come away by ulceration, lest, if forcibly removed too early, important adhesions be torn.

RUPTURE OR SPRAIN FRACTURE OF THE LIGAMENTUM PATELLÆ.

BY WILLIAM H. LUCKETT, M.D.,
OF NEW YORK CITY.

RUPTURE of the quadriceps tendon above the patella is fairly frequent. Fracture of the patella is common, but rupture of the tendon below the patella is rare. The case reported below probably belongs to the class first described by Collender. Sir Wm. Bennet has also called attention to this class of injury, and Ross and Stewart have recently carried on some experimental work, the correctness of which this case tends to prove.

R. D., casemaker, fifty-one years old; admitted to my service at Bellevue and Allied Hospitals, Harlem Division, Jan. 7, 1912; discharged cured Feb. 12, 1912.

Present History.—Patient is said to have fallen in the street while under the influence of alcohol, so the exact mechanism of the injury is not known. The patient says that his right foot slipped forward and then he fell onto his right side on top of his right leg. The patient was unable to walk and unable to extend the right leg at the knee.

Examination.—Inspection reveals obliteration of the normal topography of the knee, some slight ecchymosis, and a small abrasions of skin over patella. The patella is on a higher level, about $1\frac{1}{2}$ inches, than its fellow of the opposite side; on flexion of the leg upon the thigh the patella does not move downward.

Palpation.—The tendon cannot be felt at the lower border of the patella. The patella itself is very freely movable. A groove can be distinctly felt just beneath the lower border of the patella, running transversely across the knee; no crepitation.

An X-ray picture (Fig. 1) shows the patella tendon pulled away from its attachment to the patella, curved backward and tucked in between the femur and tibia in the intercondyloid notch. There can be seen in the X-ray picture also some fragments of the bone that were pulled away from the patella. The power of extension is totally lost.

FIG. 1.



X-ray before operation. Note elevation of patella and two small pieces of bone pulled away with tendon from patella and driven by atmospheric pressure between condyles.

FIG. 2.



X-ray six weeks after operation.

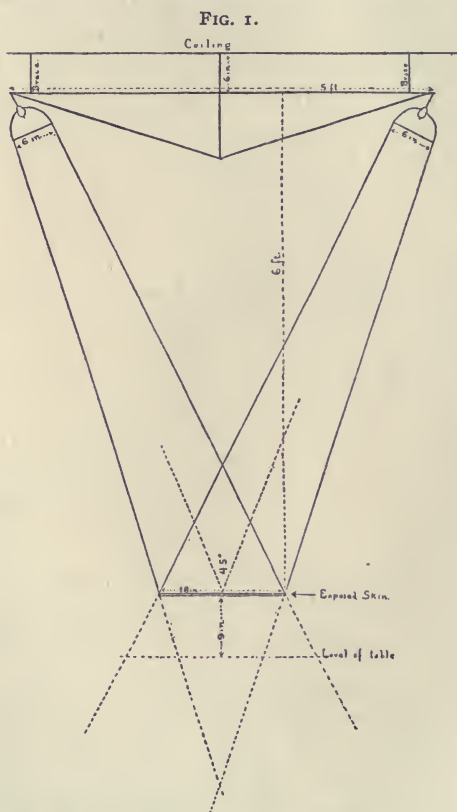
Operation (Jan. 12, 1912).—The joint was opened by a semi-circular incision sweeping downward from the inner condyle around beneath the patella and upward to the outer condyle. The skin and soft parts were retracted; the joint opened and irrigated with 0.5 per cent. carbolic solution. A blood-clot and the torn end of the tendon was withdrawn from its prolapsed position in the intercondyloid notch. The tendon was sutured to the aponeurosis and periosteum of the patella with kangaroo tendon. The lateral expansion of the aponeurosis was found to be torn through almost one-half the circumference of the knee. This was sutured with kangaroo tendon. The skin was then sutured; posterior splint applied. January 24, twelve days after operation first dressing, wound perfectly clean, primary union. Aside from a profound bromide rash the patient had an uneventful recovery. The bromides were administered enthusiastically by the house-surgeon to control alcoholic delirium tremens. The patient, in fact, was in mild delirium for the first three weeks of his sojourn in the hospital.

The tear or rupture of the lateral expansion of the aponeurosis of the quadriceps tendon in this case was no less important than the injury to the tendon itself. The injury to the aponeurosis was very much more extensive than is usually found accompanying fractures of the patella. The fascia lata over the knee is very strong, and receives fibrous extension from the tendon of the biceps externally and from the sartorius internally and quadriceps extensor cruris in front. So it will be seen that through it there are exercised great powers of extension. It is just as important to close this rent in the fascia lata as it is to repair the rupture of the tendon itself. In this case the tear of the aponeurosis was so extensive as to reach through half of the circumference of the knee, necessitating an extension of both ends of our skin incision to reach its limits.

A METHOD OF FOCUSING SEVERAL ELECTRIC LIGHTS ON THE FIELD OF OPERATION.

BY WILLARD BARTLETT, M.D.,
OF ST. LOUIS, MO.

It is not the writer's primary object to discuss, in this brief article, the relative merits of natural and artificial light-

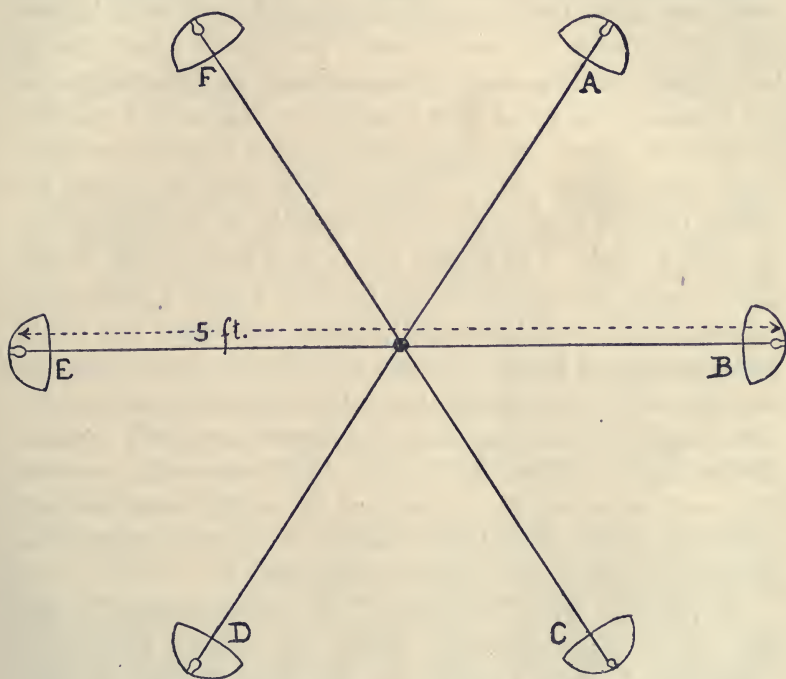


Showing how the light is converged from the six-inch reflectors into an 18-inch field.

ing for the operating room; however, it may not be out of place to mention, in passing, the inherent difficulties connected with the skylight, which has heretofore afforded practically

the only adequate illumination for this purpose. Many of the hospitals which were built before the present decade have *no* skylight, and it may be urged that many such contrivances leak in a hard rain, are difficult to keep clean, especially in cities like St. Louis, where there is much soot, make the operating room as hot as an oven in summer, and in winter are frequently obscured by sleet and snow. Especially is the

FIG. 2.



Illustrating the arrangement of the six sources of light.

double-decked skylight to be condemned, since the lower horizontal deck practically always cuts out an undue amount of light. It goes without saying that the intensity of illumination varies with the hour of the day as well as with the character of the sky, to say nothing of the fact that an operator who is accustomed to a certain quality of light during the daylight hours is dependent upon one with which he is unfamiliar at night.

The above reasoning should not, perhaps, lead one so far as to conclude that the ideal operating room of the future will be constructed without a skylight, but the thought suggests itself forcibly as I employ an artificial lighting system which I recently devised for St. Anthony's Hospital. Two diagrams are submitted which will, I think, make clear the manner in which I have used six electric globes of 15-candle-power with a parabolic reflector behind each. This is the ordinary equipment seen upon modern automobiles, and, as is well known, each light throws a powerful beam, the rays of which diverge but slightly. When six of these, situated at different points, are focused on a given field it stands to reason that the illumination is intense and that in this manner shadows are practically done away with. The source of light is so near the ceiling that no heat from it is noticeable at the level of the operator's head. The globes are frosted and a soft, diffuse glow results. The satisfaction of having a known quality and constant quantity of light at all times is one which will not be fully appreciated by the operator who has not been in possession of it. The fact that beams of light from six sources meet at an angle of more than forty-five degrees naturally cuts out all the shadows which obscure the depths of certain wounds. This will be especially appreciated in certain common duct operations, pelvic procedures, attempts to reach the root of the gasserian ganglion, and others of like nature.

It required some calculating and experimenting on the part of an expert electrician before we secured exactly the "resistance" which brought out the full brilliancy of these tiny six-volt globes. The cost of the material used was less than \$25.00—surprisingly little when the result is considered.

Requests for technical information will gladly be turned over to the expert connected with the supply house where my material was purchased.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated Meeting, held at the New York Academy of Medicine,
October 23, 1912.*

The President, DR. CHARLES L. GIBSON, in the Chair.

BANTI'S DISEASE.

DR. ARPAD G. GERSTER presented a man, 25 years old, who was admitted to the Mt. Sinai Hospital, on December 3, 1909. The history obtained was that about a year prior to his admission he began to experience a heavy dragging sensation in the abdomen, with slight pain in the back. The pain gradually became more severe, and was located principally in the left hypochondrium and in the lumbar region. The pain did not radiate. There was frequency of urination, both diurnal and nocturnal, with hæmaturia. The patient said he felt weak, and had lost some weight.

Examination revealed a large tumor filling up the entire left upper quadrant and extending somewhat beyond the middle line. This tumor mass had a rounded border and was very mobile, so that it could be pushed from side to side. On inflation of the colon there was tympany in front of the mass. The urine always contained considerable albumin and many red blood-cells; no tubercle bacilli. An examination of the blood gave 4800 white blood-cells, with 85 per cent. of hæmaglobin.

The case was diagnosed as one of Banti's disease, and in December, 1909, Dr. Gerster removed the enlarged spleen through a six-inch incision made parallel to the costal border. The spleen was freely movable, but it was found to be adherent to the stomach above, necessitating resection of a segment of the fundus two and a half inches long. The defect was afterward closed by double suture. The liver was found shrunken and of

the hob-nail type. The abdominal wound was closed, with drainage, and the patient's convalescence was uneventful for ten days, when he developed a high temperature, with remissions and chills and free fluid in the peritoneum. Thrombophlebitis of the splenic vein was suspected, and twelve days after the original operation the abdomen was again opened through a median epigastric incision. There were no evidences of peritonitis, but the abdomen was found to be filled with bloody serum. All the different branches of the portal vein were much distended, the splenic vein exposed by an incision through the lesser omentum being as large as a man's thumb. No clot could be found. The patient's condition at this time was not very favorable, and further operative search was abandoned.

Following this exploratory laparotomy, the patient's temperature ranged between 99° and 102° for two weeks, with occasional chills. Then, after 35 days, it gradually fell to normal; the patient continued to improve, and was discharged, well, on March 9, 1910.

Dr. Gerster remarked that the pain and tumor in the left flank and hæmaturia, which was traced to the left kidney, naturally led to the suspicion that this kidney was either accidentally or coincidently involved with the spleen. As subsequent events showed, the renal symptoms were entirely due to compression, and all the symptoms, including very characteristic attacks of renal colic, which, in fact, was the symptom that had brought the man to the hospital, disappeared with the removal of the enlarged spleen.

Dr. WALTON MARTIN said he had seen a patient with great enlargement of the spleen and slight enlargement of the liver about four weeks ago, and with slight anæmia, and no leucocytosis. The case suggested the one shown by Dr. Gerster. As the patient's condition was fair, and as there had been no hemorrhages, surgical operation had not been advised. The favorable outcome in Dr. Gerster's case would lead Dr. Martin to advise an operation in this case.

Dr. CLARENCE A. McWILLIAMS said he recently saw a typical case of Banti's disease at the Presbyterian Hospital. The spleen was very much enlarged, and Dr. Joseph A. Blake removed it with considerable difficulty on account of adhesions. Three or four days after the splenectomy the patient developed a tempera-

ture, going as high as 102.5° , and this continued for two weeks without apparent cause. There was no ascites. It had been suggested that perhaps this temperature elevation was an essential feature of the disease itself.

DR. GERSTER, in closing, said that in his case he did not doubt that there was a thrombosis of the portal vein, and such thrombi were usually accompanied by temperatures showing a very steep curve. If the thrombus happened to be of a septic nature, death usually followed, but even under those grave conditions recoveries had been reported.

TUBERCULOSIS OF THE COSTAL CARTILAGES.

DR. A. V. MOSCHCOWITZ presented a negro, 38 years old, who was admitted to the Mt. Sinai Hospital on September 23, 1912, with the history that one year ago his right great toe was amputated at his home for osteomyelitis. Ten years ago there was a genital infection for which the patient was treated with mercury and iodides.

His present history dated back ten months, when there developed a tender mass over the lower part of the right chest. This was incised and drained, and had been discharging pus ever since that time. On physical examination there was found a sinus just below the right nipple, which led to a depth of about four inches in various directions. The axillary, femoral, and epitrochlear glands were enlarged, and there was a tubercular infection of the apex of the left lung.

The patient was operated on by Dr. Moschcowitz, on September 28, in the following manner: A rather irregular incision was made, exposing all the diseased cartilages and one rib. The diseased tissue was then thoroughly extirpated, and the exposed cartilages were covered by flaps of muscular or aponeurotic tissue obtained from adjacent structures, and the entire wound was closed with the exception of that part which corresponded to the necrotic rib.

The sutured portion of the wound healed by primary union. October 19, there was a small collection of serum at the inner angle of the wound, which had to be opened, but the speaker said he did not believe that this led down to the cartilages.

The pathological report by Dr. F. S. Mandlebaum confirmed the diagnosis of tuberculosis.

Dr. Moschcowitz said he presumed he only voiced the sentiments of other surgeons when he stated that tuberculosis of the cartilages of the ribs was rather difficult to cure, no matter how radical the procedure adopted to eradicate it. The speaker said that, as a matter of fact, he had noticed that this was also true when operating upon cartilages in other parts of the body, and he had been led to the conclusion that this failure to effect a cure was due not so much to the inadequacy of the operative method, but to the after-treatment. When operating on such infected tissues, it was quite natural to take recourse to packing the wound with either sterile or iodoform gauze. Here, he believed, was just where the fault lay in our failures to cure these patients. The low vitality of cartilaginous tissues was well known, and they would not tolerate any prolonged contact with gauze. In this case, therefore, he had adopted a different procedure, and a few days before his attention was called to an article by Axhausen, in Langenbeck's Archiv, in which the writer advocated a similar method.

Dr. Moschcowitz said he expected to report the final outcome of this case at a later date.

PROLAPSE OF THE RECTUM.

DR. MOSCHCOWITZ presented a woman, 55 years old, who was admitted to the Mt. Sinai Hospital, in the service of Dr. Arpad G. Gerster, on March 16, 1912. The history obtained was that for the past 25 years she had been suffering with symptoms of a mass protruding from the rectum. These symptoms had become particularly aggravated during the past three years, so that during that time she had made no attempts whatsoever to reduce the mass, which she had previously been able to do.

Examination showed a protruding prolapse of the rectum, about three and a half inches in length. The sphincters were completely relaxed, easily permitting introduction of the entire hand. The surface of the prolapsed rectum was ulcerated from constant friction against the clothing.

Operation, March 21, 1912: The method of procedure in this case was that described by Dr. Moschcowitz in an article entitled "The Pathogenesis, Anatomy and Cure of Prolapse of the Rectum," which was published in *Surgery, Gynecology and Obstetrics*, July, 1912. Four rows of circular Pagenstecher

sutures were inserted to completely obliterate the pelvis. Primary union resulted, and the patient left the hospital three weeks from the date of the operation. At the present time there was not the slightest evidence of a protrusion, even upon great exertion. The sphincters had regained their normal condition, and the result thus far might be termed an ideal one.

DR. HOWARD D. COLLINS said he thought that Dr. Moschcowitz's idea of obliterating Douglas's cul-de-sac in the treatment of prolapse of the rectum overcame one difficulty which was met with in these cases. His own method had been to suture the lines of the rectum to the peritoneum on the pelvic wall, and his results had been perfectly satisfactory excepting in those cases where the patients had been allowed to become constipated during the period of their convalescence. His method, the speaker said, had a tendency to flatten out the rectum, and if a large mass of fecal matter was allowed to pass through the rectum, the stitches were torn out or the peritoneum was stretched to such a degree that the benefits of the operation were lost, whereas the method described by Dr. Moschcowitz had a tendency to keep the lumen of the rectum open.

DR. JAMES M. HITZROT said he could speak in favor of this method from personal experience. In July of the present year a young woman entered the New York Hospital, presenting a rectal prolapse of about six inches, which she had had since she was a small child—she was now a girl of twenty. Dr. Hitzrot said he operated on her by this method with very good success. He had intended to show her at this meeting, but she left the hospital three weeks after the operation and had returned to her home in Nebraska.

DR. F. KAMMERER inquired if this method was not similar to that described by Quénu and Duval, in the *Revue de Chirurgie*, February, 1910. About a year ago, the speaker said, at one of the meetings of this Society, he showed a patient upon whom he had done the operation, as described by these two authors, apparently with very satisfactory results. The patient was a woman with a rectal prolapse of four or five inches, which he had previously tried to correct by various expedients but without success. The prolapse was originally of traumatic origin. After carrying out the method described by Dr. Moschcowitz, the patient remained well for about ten months; then the prolapse recurred.

Dr. Kammerer said that in dealing with this condition of rectal prolapse he had seen good results following various operative expedients, including that of Dieffenbach of excision of the posterior wall of the rectum, together with the sphincter; also by denudation of the iliac fossa and attaching the bowel to the denuded surface. The success of the operation depended largely upon the kind of prolapse one had to deal with.

DR. HENRY H. M. LYLE said he had tried the method described by Dr. Moschcowitz in a case of prolapse of the uterus, with descent of the posterior wall. In this case, closure of the cul-de-sac of Douglas gave very good support. The operation was done two months ago, and the patient's condition was thus far very good.

DR. GERSTER said his experience with the various operations for the correction of rectal prolapse had been very similar to that of Dr. Kammerer, and while the results of many of these procedures were excellent, they were, unfortunately, only temporary. The studies of Dr. Moschcowitz had demonstrated that the failure to obtain permanent relief was due to the fact that we had neglected to seek out and correct the real causative factor of this condition, *i.e.*, that a prolapse of the rectum was always due to a laxity of the pelvic floor, and this could not be better remedied than by the method employed in the case shown at this meeting. Of course, the method was still in an experimental stage, but it came nearer the purpose than any of the two score or more plastic procedures that had been recommended and tried heretofore. In women, the operation described by Dr. Moschcowitz was comparatively simple; in men, it would sometimes prove very difficult. If a sufficient number of sutures were placed, the final outcome of the operation, which was still in doubt, should be very good.

DR. MOSHCOWITZ said that entirely aside from making any claim of priority for this method of operation, he merely wished to call attention to the fact that Quénu and Duval published their article on the subject in the *Revue de Chirurgie* in 1910, while he did his first operation by this method fully five and a half years ago. The speaker said that while abroad this summer he discussed the subject with Dr. Quénu, who had informed him that the idea of their operation was essentially a colopexy. In this connection he might call attention to the fact that over ten

years ago Bardenhauer operated on these cases by a method not unlike that of Quénu and Duval.

DR. KAMMERER said that in the remark he made he did not have in mind the question of priority. He had not yet read Dr. Moschowitz's recent publication and, before discussing the subject, wished to know if the two procedures are based on the same principle of technic.

TUBERCULOSIS OF THE SHAFT OF THE LONG BONES.

DR. FRANK S. MATHEWS showed three cases of tuberculosis of the shaft of the long bones not involving the adjacent joints. In the first case, a focus in the lower end of the humerus had made a fusiform swelling above the elbow. The tuberculous segment had been excised subperiosteally and the wound closed. The segment had re-formed in two months.

In the second case shown there was tuberculosis of the whole shaft of the humerus, with many sinuses, but no X-ray or clinical evidence of joint involvement. Early treatment like that in the first case might have resulted in a cure without the present extensive involvement of bone and soft parts.

The third case was a tuberculosis of the lower half of the shaft of the femur. An abscess and sinus had formed, and the bone destruction had been considerable. The child's condition was desperate. Subperiosteal resection of the lower half of the femur down to the epiphyseal cartilage of the knee had been done. Bone had re-formed, but there was still a sinus.

Dr. Mathews, while in general advocating the orthopædic rather than the operative treatment of joint cases, urged the wisdom of early diagnosis of foci in the shaft or ends of diaphyses of the long bones, and their early subperiosteal removal to prevent joint tuberculosis and to curtail the period of treatment.

DR. MARTIN, referring to an X-ray negative which he had shown in connection with the cases presented by Dr. Mathews, said the case was that of a child, two and a half years old, where a large section of the shaft of the ulna had been removed for tuberculosis. There were no sinuses, and the child made a good recovery without involvement of the joints. The case was exactly similar to those reported by Dr. Mathews.

DR. RUSSELL said he was interested in the statement quoted by Dr. Mathews that a resection of the shaft did not interfere

with the growth of the bone, as there was a rather wide-spread belief among surgeons that resection of the long bones in children might result in possible shortening. The speaker said there were several cases of compound separation of the lower epiphysis of the femur in which the diaphysis had been resected, resulting in progressive shortening extending over several years.

DR. GERSTER said that Dr. Mathews, in his presentation of these cases of tuberculosis of the shaft of the long bones, touched upon a very important surgical principle. In the early days of aseptic surgery, when we first began to attack tuberculous joints under the leadership of Professor Volkmann, the tendency was to go too far, and primary resections were very common until we were frightened from that extreme position by the observation that many cases of miliary tuberculosis followed these extensive surgical procedures. The dictum then taught that tuberculosis of the joints should be regarded and treated like a malignant disease was gradually abandoned, and we swung back to the other extreme and turned these cases over to the orthopædists, who achieved such brilliant results with orthopædic measures combined with general treatment that radical surgical interference was rarely resorted to.

In the cases shown by Dr. Mathews the fact was demonstrated that when we had to deal with a tuberculous focus either in the diaphysis or epiphysis of the long bones where perforation into the joint was to be feared with reasonable certainty, it was rational to cut down and remove that focus. This was one of the teachings of Volkmann, and now, when, with the aid of the X-rays, an early and accurate diagnosis could easily be made, this operation deserves to be characterized as eminently conservative.

DR. MATHEWS, in closing, replying to Dr. Russell, said that in making the statement that resection of the shaft of the bone did not interfere with its growth, he had quoted Stiles as authority for the statement.

Dr. Mathews said that in the three cases he had shown, the conditions were not ideal. In dealing with an early tuberculosis of the shaft, he thought it was better to do a resection than to rely on the expectant treatment, with the risk of perforation into the joint. Personally, he was strongly opposed to a resection of the hip in a child, as the result was usually very bad, with de-

cided shortening. After such a resection, the arrest of growth was not limited to the hip, but involved every epiphysis from the hip down to the toes, and the resulting shortening was very pronounced, sometimes as much as ten inches. Dr. Mathews said he had never seen this fact mentioned in the text-books.

DR. ROYAL WHITMAN said he had thought it well known that in cases of hip-joint disease in childhood, whether operated on or not, or whenever from any cause there was loss of function for a long period, growth was checked in some degree, not only in the bone directly involved, but in all the bones and tissues of the limb.

TRAUMATIC SEPARATION OF THE LOWER EPIPHYSIS OF THE FEMUR.

DR. JAMES I. RUSSELL read a paper with the above title, for which see page 869, vol. lvi.

DR. GERSTER said that one of his earliest surgical experiences dated back to the year 1872 or 1873, while serving as assistant surgeon in the Austrian army. One day a young recruit was struck on the head by a heavy straw mattress, which had been thrown from one of the upper floors of the barracks. Upon recovering consciousness he was unable to walk and complained bitterly of pain in one of his legs. A dislocation of the knee-joint was suspected: crepitus was felt, a large hæmatoma rapidly developed, and separation of the epiphysis was diagnosed. The fragments were easily replaced, and the patient eventually recovered with good use of the limb. The toes being cold, this and the presence of the hæmatoma led to the suspicion that a large vessel might have been ruptured. This fear proved to be groundless.

BOOK REVIEW.

SURGICAL AFTER-TREATMENT. By L. R. G. CRANDON, M.D., Assistant in Surgery at Harvard Medical School, and ALBERT EHRENFRIED, M.D., Assistant in Anatomy at Harvard Medical School. Second edition, practically rewritten. Octavo of 831 pages, with 264 original illustrations. Philadelphia and London: W. B. Saunders Company, 1912.

THIS work, now in its second edition, has been thoroughly revised and in large part rewritten. It is intended to appeal especially to hospital residents, surgical assistants, and those who are called upon to care for surgical cases in communities which are not hospital centres.

Although completely modernized, most of its contents are teachings which have stood the test of time, and which represent not only the originality of the authors but also the generally accepted thought and practice in the care of surgical patients.

The work is divided into two parts, the first of which contains chapters given to the consideration of subjects of general interest, such as the arrangement of the sick-room, the nurse's chart, post-anæsthetic nausea, pain, shock, coma, hemorrhage, pulmonary embolism, and artificial respiration. Then follow chapters on diet, rectal feeding, catheterization, the care of the bowels, acute gastric dilatation, and post-operative intestinal obstruction. Bandaging, the management of the operative wound, dressings, removal of sutures, and the subject of drainage are next considered, together with the management of infected wounds, sinuses and fistulæ. Part I is concluded with a consideration of the indications for massage, X-ray therapy and radium, and somewhat out of order, so far as the arrangement of the text is concerned, is here added a chapter on the preparation of the patient for operation.

In Part II the management of post-operative conditions is considered in regional form, a chapter being given to each of the various regions of the body and to each group of organs or tissues of similar structure. In these chapters are discussed not

only the normal cases but also the management of the various complications and abnormalities to which each one is subject.

One of the most valuable contributions to the work is the chapter on therapeutic immunization and vaccine therapy which was prepared by Dr. George P. Sanborn. It is thorough and at the same time concise, and presents all of the more important essentials for the application of this valuable adjuvant to surgical science.

A complete index of authors is appended, and the text is liberally interspersed with charts, drawings, and photographic reproductions, most of which are original and serve well to illustrate the methods and ideas as described in the text. On the whole, the book is a very satisfactory and comprehensive treatise on the subject of surgical after-treatment and serves admirably the purpose for which the authors have intended it.

WALTER A. SHERWOOD.

THE PITUITARY BODY AND ITS DISORDERS. By HARVEY CUSHING, M.D., Associate Professor of Surgery, The Johns Hopkins University; Professor of Surgery (Elect), Harvard University. Octavo, 341 pages, 319 illustrations. Philadelphia and London: J. B. Lippincott Company, 1912.

ONLY at rare intervals in the history of medical literature does a book appear which stands out as something striking and fundamental. Such an epoch-making volume is Cushing's recent classical monograph on hypophyseal disease. Though numerous scattered papers have been published in the past twenty-five years, and especially in the last decade, on the disorders of the pituitary body, it has remained for an American surgeon to give to the world for the first time a systematic and crystallized conception of the varied clinical manifestations resulting from pathological lesions of this organ. The book is no mere compilation of the literature, but is mainly the result of a most extensive personal clinical experience and experimental research, and it will undoubtedly rank as the reference work of the future on the diseases of the hypophysis cerebri. It is possible that some of Cushing's deductions may be disproved by coming investigators, yet it is certain that his book will stand out pre-eminent as the first attempt to present in a concrete scientific form a com-

plete picture of the various clinical states produced by disease of the pituitary gland.

The volume is an outgrowth of a lecture delivered before the Harvey Society in December, 1910. The twenty cases, on which this lecture was based, were more than doubled in the succeeding nine months. From these two-score odd accurate clinical studies and extensive experimental work, of which only a portion has already been published, this book has developed.

In Part I, the morphology and histology of the gland, including its mode of secretion, the question of accessory glandules, and its circulation, are briefly considered. Considerable space is devoted to the known facts of hypophyseal physiology, obtained by the injection and ingestion of extracts, by glandular transplantation, and by extirpation methods. As is well known, it is the last of these methods that has given us the most information, and Cushing and his assistants have contributed not a little to our knowledge on this score. He believes with Paulesco that total hypophysectomy is fatal and that the lethal outcome is due in the main to the loss of the anterior lobe. His results with partial hypophysectomy are also incorporated, and from these have been obtained the first experimental proof that certain hitherto imperfectly understood clinical phenomena are due to lessened glandular activity or hypopituitarism. He has reproduced the adiposogenital dystrophy of Bartels or the Froehlich type in puppies, and, what is still more significant, he has succeeded in producing a post-adolescent form with adiposity and sexual atrophy in adult canines.

In this section he also calls attention to his thermic reaction found upon injection of pars anterior in anterior lobe deficiency. He utilizes this as a diagnostic test. The necessity of normal posterior lobe activity to effective carbohydrate metabolism is also considered. Glycogenolysis and emaciation occur after injection of posterior lobe extract, and adiposity and high sugar tolerance are found in posterior lobe deficiency. Part I is concluded by a somewhat too brief discussion of the pathology and chemistry of the organ.

Part II, which is really the body of the work, is devoted to an admirable clinical analysis of a series of forty-seven cases, which Cushing has had the opportunity to study in the past two years. He has grouped these cases of dyspituitarism into an original

classification, which he himself modestly suggests as provisional, but which for the present is certainly an excellent working basis.

He forms five main divisions, as follows: (1) cases with marked neighborhood and glandular symptoms; (2) cases with marked neighborhood but absent or inconspicuous glandular symptoms; (3) cases with marked glandular but absent or inconspicuous neighborhood symptoms; (4) cases of obvious distant cerebral lesions with accompanying symptoms of secondary involvement of the hypophysis; (5) cases of polyglandular disease.

The first four groups are subdivided into (*a*) predominant hyperpituitarism; (*b*) predominant hypopituitarism, and (*c*) mixed or transition cases,—dyspituitarism. In subdivision *a* we have (*x*) the pre-adolescent form or gigantism, *typus Launois*, and (*y*) the post-adolescent form or acromegaly, *typus Marie*. In *b* we likewise find (*x*) the pre-adolescent form, adiposity with skeletal and sexual infantilism, *typus Froehlich*, and (*y*) the post-adolescent form of adiposity with sexual atrophy, the type which Cushing has produced experimentally, of which he gives clinical illustrations, and for which the reviewer would suggest the title, *typus Cushing*. Among Cushing's cases are found examples of the majority of the various main groups and their subdivisions.

As Cushing points out, the main defect in this classification is due to the dual nature of the gland, which has an anterior lobe associated with growth and a posterior lobe affecting tissue metabolism. Hence, one or both lobes may be involved, either or both may be over- or under-active, the over- or under-activity of either or both lobes may begin in infancy or in adult life, and finally the over-activity of either or of both lobes may be followed by an insufficiency of either one or both parts of the gland. The innumerable combinations can readily be imagined, and it will be seen that it is necessary to interpret each individual case on its merits, as Cushing does, and that one cannot be content with placing this or that case into an arbitrary class.

The above classification applies primarily to cases of gross lesions, particularly tumors, of the hypophysis. The question is further complicated by the possible existence of a merely functional over- or under-activity of the gland without demonstrable anatomical changes.

The case histories are fascinating reading. They are not

the usual compilation of dull historical data, for aside from the fact that the cases themselves are out of the ordinary, they are described in so interesting a fashion that the reader frequently feels he is actually becoming acquainted with this or that particular patient, just as one learns to know a character from a novel or a biographical sketch. The summary of the hypophyseal symptoms and the epicritical analysis in each case deserve special commendation. The histories are further enlivened by excellently chosen photographs, and by radiographs of the sella and extremities, which are reproduced in their natural size. Perimeter charts, photographs of pathological specimens, and microphotographs of the pathological findings are added wherever possible.

Part III is devoted to an analytical review of the incidence, the symptomatology, and the treatment of hypophyseal disease based mainly upon the author's personal experience. It would be impossible in the space allotted to me to give a satisfactory abstract of this portion of the book. Every sentence is significant, and I shall only indicate the general trend of the argument. Each particular symptom, neighborhood, general pressure, glandular, and polyglandular, is carefully analyzed and its relative importance dwelt upon. Three new cases are added to illustrate hypophyseal glycosuria and hypophyseal epilepsy. Perhaps a trifle too much stress is laid upon the significance of glycosuria in hyperactivity and increased carbohydrate tolerance in insufficiency of the posterior lobe.

The lesion itself, certified in twenty-nine cases, is next discussed, and finally the question of treatment is taken up in detail. The indications for surgical intervention, namely, to relieve the general pressure symptoms, to combat the functional hyperplasia, and to relieve the neighborhood symptoms, are considered *seriatim*, and the various methods of approach are reviewed.

For direct sellar approach Cushing has finally adopted a one-stage transphenoidal operation with sublabial incision and submucous septal resection. This is practically a combination of Kanavel's inferior nasal and Hirsch's endonasal operation. Every effort should be made to avoid lacerating the mucous membrane, and the turbinates are flattened out by retraction and dilatation, but not removed. The use of urotropin as a preventative against meningitis, and the importance of careful radio-

graphic study as a means of orientation, the necessity of perfect anæsthesia, and the danger, if one's direction is wrong, of perforating the cribriform plate of the ethmoid, are emphasized.

By the transphenoidal approach local sellar decompression, partial extirpation, or cyst evacuation may be accomplished. A subtemporal approach may be used for simple decompression, especially in superimposed lesions, or for combined decompression and exploration. Finally both avenues of approach, intra- and extracranial, may be combined. Cushing has performed these various operations either single or combined on 43 patients, who have been subjected, all told, to 61 operations. A table of these cases is appended. Of the 43 cases, only 28 are included in Part II, and 15 are new cases added since the completion of that portion of the work. Cushing has had by far the largest individual operative experience, and his results are, for this reason, if for no other, of the utmost significance. The mortality in 29 actual transphenoidal attacks was only 13.7 per cent. The main result of operation has been the relief of neighborhood symptoms. Symptoms of intracranial tension are likewise improved, and it is hoped that hyperpituitarism may yet be influenced. Glandular implantation in hypopituitarism is looked upon as a further possibility of surgical intervention. Further, a preliminary sellar or subtemporal decompression, or both, is suggested as a means for more effective radiotherapy.

The matter of glandular therapy in hypopituitarism by ingestion and injection is next taken up. Cushing has seen some very definite results from these measures, particularly as far as the adiposity and the subjective symptoms resulting from glandular insufficiency are concerned. An ingenious suggestion for determining the dosage is offered. The patient should be given daily enough glucose to cause glycosuria in a normal person of equal body-weight and then increasing amounts of glandular extract are given till a trace of sugar occurs in the urine of the patient, who, of course, originally had an increased tolerance. Injection is the more effective measure, and in two cases overcame the somnolence, when feeding failed.

The possibility of the beneficial effects of glandular transplantation are considered, and one case is recorded in which Cushing had the opportunity to carry out this procedure. The result was extremely satisfactory.

X-ray treatment, especially in combination with operative measures, promises to be useful in cases of strumous hyperplasia, especially where the tumor symptoms predominate. Neighborhood and pressure symptoms have both been influenced in some of the later cases, and it is suggested that the X-ray may effect the growth of cells in the struma, much in the same way as the cell division of the spermatogenous epithelium of the testis is arrested.

An exhaustive bibliography of 256 numbers completes the volume.

Possibly some will feel that Cushing is a trifle too speculative in his inferences and somewhat over-enthusiastic in his conclusions. These attributes, which give the work a distinct individuality, merit rather praise than condemnation. Would any scientific progress be possible without a certain amount of imagination and optimism on the part of the investigator? Cushing's book is a great step forward, and it will be an enduring monument to the earnest and able efforts of its author. The volume should be in the private library of every physician, for there is practically no specialty in medicine which is not overlapped by the subject under discussion. Of especial importance, however, is the book to the surgeon, for it is from him that the definite practical results are to come in the treatment of those unfortunates suffering from pituitary disease.

DE WITT STETTEN.

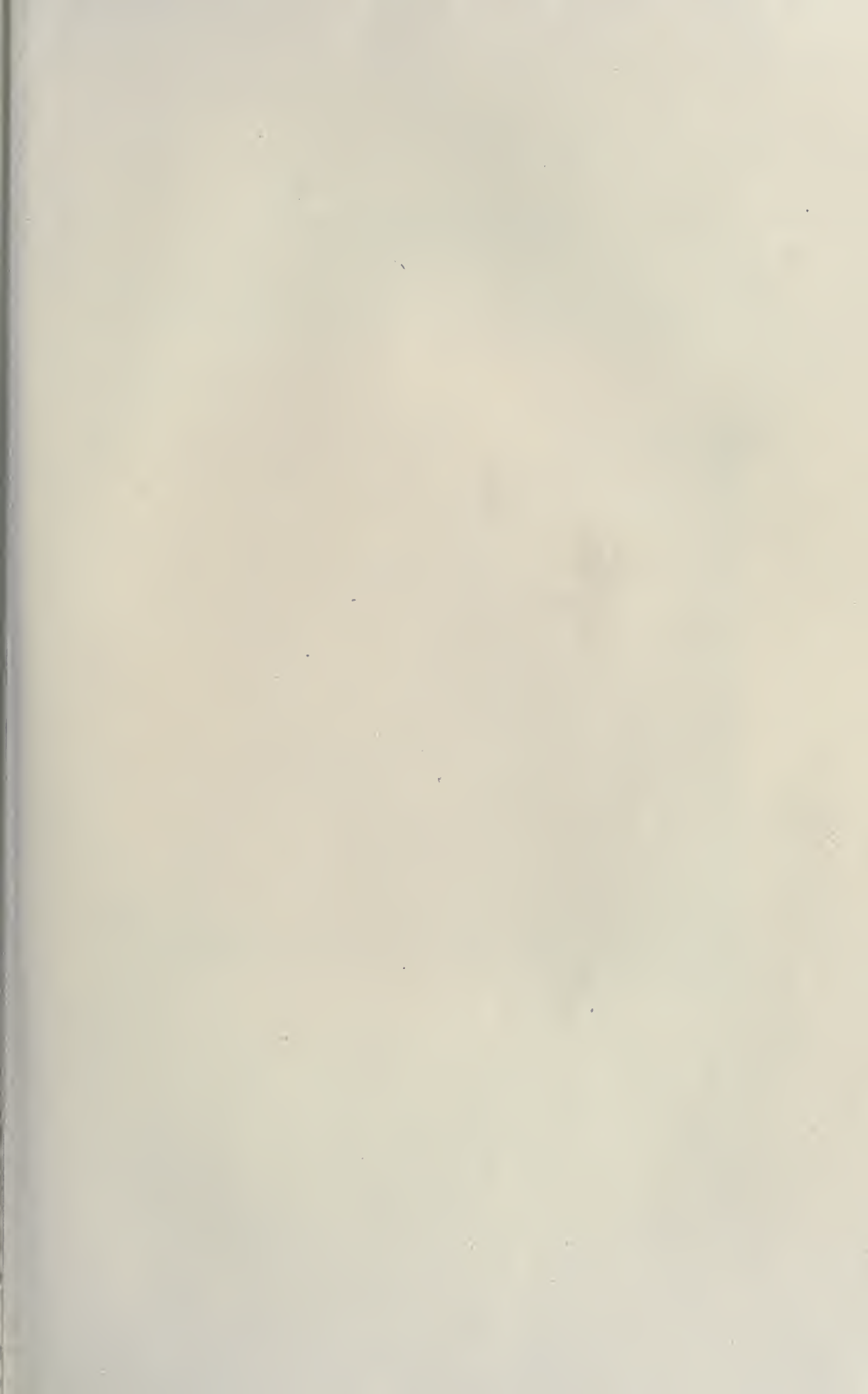


FIG. 1.



Acute suppurating subdeltoid bursitis.

CORRESPONDENCE.

ACUTE SUPPURATING BURSTITIS OF THE SUBDELTOID BURSA.

EDITOR ANNALS OF SURGERY:

As instances of acute suppurating inflammation of the subdeltoid bursa are not common, the report of a case with the ultimate results may not be out of place.

W. C. R., male, aet. 40 years, was first seen on September 15, 1909. A strong, well-built man, who had always enjoyed excellent health. He had never contracted gonorrhœa nor syphilis. For two days before coming under observation the patient began to experience severe pain in the right shoulder. The pain came on suddenly without any known cause, and increased to such a degree that within forty-eight hours the patient was in real agony.

Examination showed no change in the shoulder by inspection. Palpation revealed nothing excepting some pain over the deltoid, but any movement of the shoulder would cause great pain. Local applications and the internal administration of natrii salicylate gave no relief after two days' trial, the pain continuing so severe that morphine had to be given. Temperature was always normal.

On September 18 the shoulder was radiographed and a distinct outline of the subdeltoid bursa was revealed (Fig. 1) and the correct diagnosis arrived at.

Operation was done on September 19, with the kind assistance of Dr. F. J. Cotton. A posterolateral incision ten centimetres long was made, the fibres of the deltoid separated by blunt dissection, and a tense subdeltoid bursa readily brought to view. Upon incision, about five cubic centimetres of thick yellow pus escaped, which was unfortunately lost for bacteriological examination. The bursa was easily extirpated and a small rubberdam cigarette drain inserted, after which the wound was closed. Drain removed in forty-eight hours.

The arm was put up on a Munk's rectangular splint, which was worn for three weeks, after which passive and active motions

were begun, with the result that within six weeks after the operation the patient had very fair use of the arm. At the present time of writing (October 12, 1912), three years after the interference, the patient has a perfect functional result.

The obscurity of the etiological factor in this case is interesting, as the patient had never had a urethral infection, nor had he received any trauma to the shoulder. He has been in perfect health ever since.

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OPERATION UPON A NEW-BORN BABE.

EDITOR ANNALS OF SURGERY:

The rather infrequent occurrence of operation work on babes, made necessary, however, at times, is well illustrated in the following case: A male child born to Mr. and Mrs. Harry Elliott at 11 o'clock P.M., September 13, 1912, under the professional care of Dr. James A. McMurray, of Marion, Ohio. The babe had an embryonal cyst of the cord, near the body, size of a large double fist, as well as an umbilical hernia which was really more an eventration than an umbilical rupture. On consultation it was decided to give the babe a chance by operative surgery, rather than trust nature. The babe was, therefore, sent to the hospital, anæsthetized with chloroform by Dr. H. J. Lower, the mass excised, and the umbilical hernia reduced and sutured. The operative work was done on this babe exactly fourteen hours after birth. It bore the anæsthetic well, and made an uneventful recovery.

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ORIGINAL MEMOIRS

AN APPROACH TO THE HYPOPHYSIS THROUGH THE ANTERIOR CRANIAL FOSSA.*

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OF PHILADELPHIA,

Professor of Clinical Surgery in the University of Pennsylvania.

THOUGH the real advent of surgery of the hypophysis dates back little more than a half a decade—it being the last of the cerebral structures to come within the scope of surgical therapy—nevertheless in this short space of time rhinologists and surgeons have given much attention to this small and until recently very inaccessible organ, and have developed various methods of approach on the cadaver and the living subject with varying degrees of success. The hypophysis, situated as it is deep in the sella turcica and hemmed in by such important structures as the cavernous sinus, the optic tracts and chiasm, and the internal carotid artery, has for a long time been considered a *noli me tangere* by the surgeon. Indeed, in 1882, Hyrtl described even the sphenoidal sinus as being entirely beyond the reach of hand or instrument.

The incentive to surgical intervention in this particular field must be attributed to Pierre Marie, who in 1886, in a monograph on acromegaly, first suggested the etiologic relation between acromegaly and perverted function of the hypophysis. The constantly increasing number of experiments demonstrating the vital importance of this organ, and the many observations, notably Fröhlich's, of the various symp-

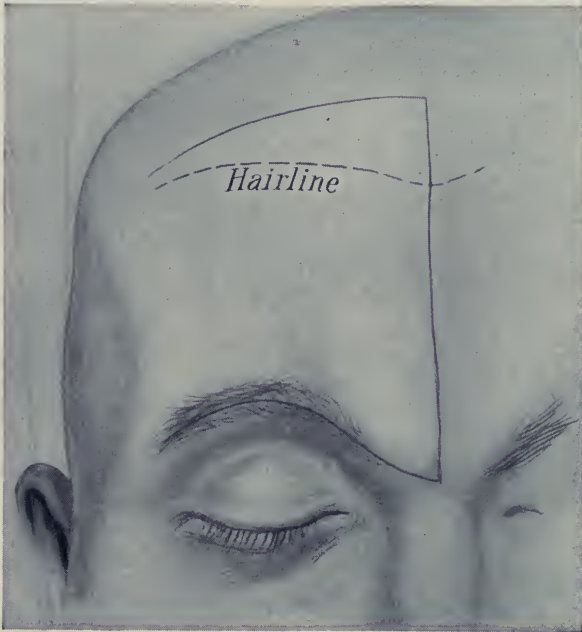
* Read before the Philadelphia Academy of Surgery, November 4, 1912.

toms complex, caused by perverted function of the pituitary and amenable in only a transitory measure to internal remedies, including organotherapy, have added greatly to the impetus to surgical intervention. Like all other intricate procedures, the operation for exposure of the hypophysis is passing through various stages of evolution, becoming constantly less complex and at the same time less mutilating, until I think I may say with perfect accuracy that I found the operation, according to the technic which I am about to describe, as easy of performance and as devoid of difficulties, though somewhat more complicated, as that on the Gasserian ganglion.

There are two principal modes of attack: the intracranial and the extracranial, each having been modified to suit the needs and the convenience of the various operators. By means of the former, the hypophysis may be reached either through the middle or the anterior cranial fossa, and the operation may be performed extradurally or intradurally.

In 1893, Caton and Paul (*Brit. Med. Jour.*, 1893, p. 1421) conceived the idea of removing a hypophyseal growth through the middle cranial fossa by elevating the temporosphenoidal lobe, but as it happened the patient died before the operation was performed. Horsley (*Brit. Med. Jour.*, 1906, i, 323) later removed a cyst of the hypophysis by this method, and recommends early incision of the dura. Dahlgren is also reported to have operated successfully through the middle fossa, but no details of the operation are to be found. Paul-esco, Cushing and Caselli have used a very similar method in their experimental work. In 1910, Silbermark (*Wien. klin. Wchnschr.*, 1910, xxiii, 467) developed a temporal intracranial method on the cadaver, consisting of a bilateral craniectomy—the counter-opening allowing dislocation of the temporal lobe without danger of compression. This operation, however, has never been performed on the living. While this method has proved very successful in canine and other experimental hypophysectomies, it seems scarcely adapted to man except in very rare instances, such, for example, as when a cyst or tumor of the pituitary extends into the infundibular region, and little attention has been given of late to this procedure.

FIG. 1.



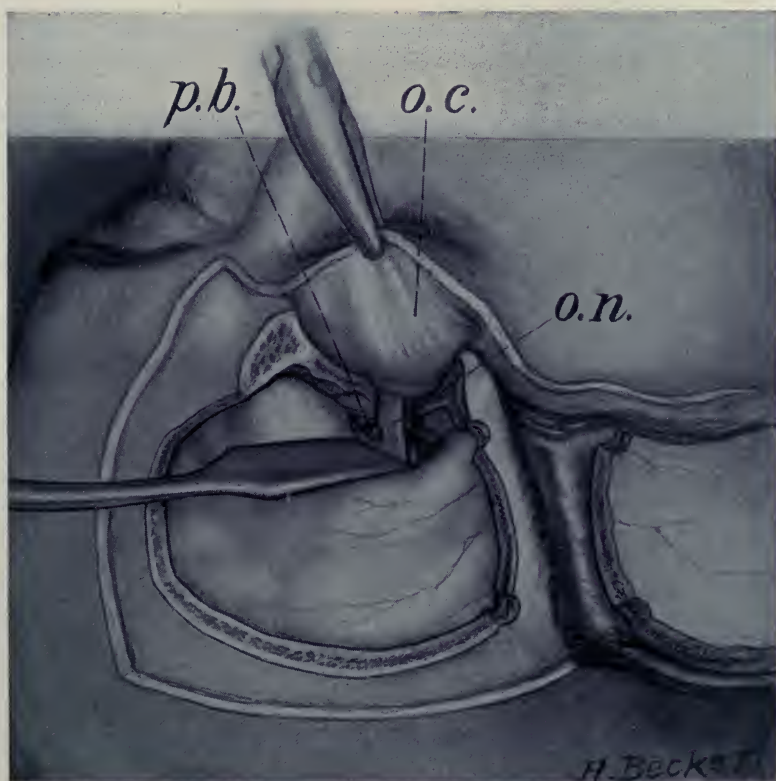
Drawing showing the relation of the incision to the eyebrow and the hair line.

FIG. 2.



Showing the reflection of the osteoplastic flap and between lines (a) and (b) the portions of the supra-orbital ridge to be resected.

FIG. 3.



With the head in the Rose position, after the supra-orbital ridge and what remains of the roof of the orbit have been removed, the frontal lobe is elevated with a retractor and the orbital contents are displaced downwards, exposing the optic nerve and immediately to the left of it, the pituitary body; *o.c.*, orbital contents; *p.b.*, pituitary body; *o.n.*, optic nerve.

Krause (*Deu. Klin.*, 1905, viii, 1004) was the first to suggest approaching the hypophysis through the anterior cranial fossa, by resecting the frontal bone and proceeding extradurally until the lesser wing of the sphenoid is reached, at which juncture the dura is incised and the hypophysis easily exposed. Borchard (*Centralbl. f. Chir.*, 1908, lxvi, 332) tried to remove a hypophyseal tumor by the above method, but was obliged to abandon the operation because of hemorrhage. Kiliani (*ANN. SURG.*, 1904, xl, 35) elaborated Krause's technic somewhat and advocates immediate incision of the dura. In 1908, McArthur performed an operation somewhat similar to Krause's with an unsuccessful outcome. He has since modified his technic, but has not to my knowledge practised it on the living subject. Last year Bogoiavlensky (*Jour. de Chir.*, 1912, viii, No. 4) performed the first successful operation through the anterior cranial fossa by a method very much like Krause's.

Most of the operations thus far have been by extracranial methods, and the surgery of the hypophysis is usually said to have its advent in 1907, when Schloffer performed his first fairly successful operation, approaching the hypophysis by the extracranial and transphenoidal route, though the experimental work of König, Löwe, and especially Giordano had paved the way for the development of Schloffer's technic. The latter, however, was somewhat crude and mutilating in character, and it has remained for others to alter and refine it. Thus, in chronological order, we find Kanavel (*Journal A.M.A.*, Nov. 20, 1909) and his intranasal operation, in which the nose is reflected upwards; Halstead (*Surg., Gyn., and Obstet.*, May, 1910) and his oronasal operation, in which the incision is made in the mucous membrane beneath the upper lip; and Hirsch (*Jour. A. M. A.*, vol. lv, p. 9) with his endonasal method. The latter is the operation of choice of all the transphenoidal methods, the conspicuous feature of which is the submucous resection of the septum and vomer, thus minimizing the danger of infection. During the past year Chiari (*Wien. klin. Wchschr.*, 1912, xxv, 1) performed two operations by a slightly different technic. He makes an incision from the inner edge of the orbit along the outer margin

of the nasal bone down to the maxillary process. The eyeball is then drawn outward, the posterior part of the nasal septum and the sphenoidal septum are resected, and the hypophysis exposed. The disfigurement, Chiari claims, is slight, as only a small portion of the nasal framework is removed. Still a different method has very recently been devised by Biehl (*Zentralb. f. Chir.*, 1912, Jan. 6) in experimental work, consisting in a suprahyoid pharyngotomy. By drawing aside the soft palate with the tenaculum, the base of the skull covering the nasopharynx up to the bifurcation of the septum is bare. The soft parts are pushed aside, under wall of the sphenoidal sinus opened, floor removed, and hypophysis readily exposed. This gives a broader approach than most extracranial methods, and has been found by Biehl very successful on the cadaver.

With one and all of these transphenoidal operations, however, there are two serious injections: One, the inevitable risk of infection from the mucous membrane. This has proven the determining factor in almost all of the 30 fatal cases. The second objection is the rather contracted avenue through which one must work to reach the sella turcica, and difficulty in securing an adequate exposure of the sella turcica and contents. The variation in size of the sphenoidal cells is a disturbing factor. When of comparatively large dimensions exposure is not so difficult; quite as often one will find cells of small dimension, through which exposure is correspondingly contracted.

I am very much in doubt whether eventually the transphenoidal route will be the operation of choice, and although there are some conditions in which this method will have to be resorted to, I believe in the future preference will be given to the intracranial route through the anterior cranial fossa. With this in mind, I have endeavored to elaborate a technic which will make the exposure of the hypophysis as feasible as the exposure of other basal structures, such as the Gasserian ganglion. The procedure, which I resorted to lately, seems to me the safest and most rational that has come to my notice. The operation consists essentially in the reflection of an osteoplastic flap from the right frontal region, in the removal *en bloc* of the supra-orbital ridge as suggested by McArthur with a

portion of the roof of the orbit, later to be replaced, and in rongeuring away what remains of the roof of the orbit down to the optic foramen. With the elevation of the frontal lobe and the depression of the orbital contents, a free and adequate exposure is secured, and there remains only to makè a short incision in the dura to lay bare the cavity of the sella turcica.

In a case referred to me recently by Dr. Franklin E. Murphy, of Kansas City, the patient, a young man of twenty-three, had been a normal child up to the age of fourteen, when he was struck with a rock over the right temporal region. Two years later, he grew perceptibly weaker, his weight began constantly to increase, and he was gradually losing the sight of his right eye. When he first came under my observation in July, 1912, his appearance was that of a thickset boy of fifteen or sixteen, with very marked panniculus adiposis. The genitalia—infantile in type—suggested a child of ten or twelve. He had an enormous appetite, and was suffering from severe headaches and occasional nausea. The ocular disturbances had advanced to a state of complete right temporal hemianopsia. Aside from these marked glandular symptoms, the X-ray findings were very suggestive of pituitary trouble. As the latter showed no material deepening of the sella turcica, I felt that the lesion would be readily exposed from above. Under intratracheal anæsthesia, the operation was carried out in the manner above described. As soon as the anterior clinoid process was reached, a transverse incision, two centimetres long, was made in the dura across from one anterior clinoid process to the other and about a centimetre above the base of the skull, and with a retractor suitably placed there was seen projecting upward between the optic tracts what proved afterward to be a pituitary cyst. The cyst was opened and evacuated. The operation was devoid of any serious difficulty, and afforded a splendid exposure of the region of the sella turcica.

This method,¹ which is a modification of McArthur's, has certain advantages over the latter's; chiefly, in that the reflection of the osteoplastic flap from the frontal region admits of greater elevation of the frontal lobe and a correspondingly freer exposure of the deep-seated structures. This is a point

¹ Since the reading of this paper this operation was repeated in a second case with equally gratifying results.

of considerable importance. Secondly the portion of bone to be resected, including the supra-orbital ridge and a portion of the orbital roof, is of smaller dimensions. As this bone must be replaced for cosmetic reasons, its nutrition will be more readily supplied than the larger fragment of McArthur's operation, and necrosis is less likely to occur. This infrafrontal route deserves careful consideration in the selection of methods for hypophyseal operations. The presence or absence of a scar in the median line of the forehead is a matter of little consequence compared with the importance of selecting a method which ensures a minimum of risk to life with a maximum of exposure.

While it is still a matter of speculation which of the two methods, the extracranial or the intracranial, will become the conventional procedure, for the time being at least the operator should be influenced by the contour and conformation of the sella turcica. Ever since Oppenheim in 1899 discovered that enlargements of the sella could be reproduced by the X-ray and correlated with an increase in size in the gland itself, the radiograph has held an important place in the diagnosis and later in the mode of removal of tumors in the uncinate region. Thus, when the radiograph shows the sella deepened and encroaching upon the sphenoidal cells with a narrow orifice, access to the hypophysis from above, that is by one of the intracranial routes, is difficult and preference should be given to the transphenoidal method, in which the approach is made from below. When, however, the sella, whether deepened or shallow, has an enlarged orifice, showing its contents have encroached on the brain and not the sphenoidal cells, the transphenoidal method is practically impossible and one of the intracranial routes is indicated. In eleven out of fourteen deaths following a transphenoidal intervention (*Toupet, Revue de Chir.*, 1912, vol. xxxii, No. 6) autopsy showed that the tumor had encroached upon the intracranial space. It is very likely that the outcome in these cases might have been quite different had the intracranial method been applied.

Thus, we see there are cases in which the intracranial method is positively indicated and should be given preference. It gives a broader avenue of approach and lessens danger of infection.

POSTOPERATIVE THROMBOPHLEBITIS.

BY ATHEL C. BURNHAM, M.D.,
OF NEW YORK CITY.

POSTOPERATIVE thrombophlebitis and postoperative embolism are of such common occurrence that they enter into the experience of every surgeon. And yet, notwithstanding the advance in postoperative treatment during recent years, they are still so common, and the consequences may be so dire, that they remain the *bête noir* of the surgical profession.

It is the hope of helping to elucidate some of the problems of these associated conditions that is responsible for the report in some detail of the following cases taken from the records of the Presbyterian Hospital, New York City, covering the period from October, 1905, to January, 1912, inclusive. These cases are published through the courtesy of Dr. Joseph Blake and of Dr. Ellsworth Eliot, Jr., and I am indebted to them for permission to study these records.

More than sixty years ago Virchow drew attention to thrombosis, although he did not distinguish it from coagulation. To-day the meaning of the term has changed, and by a thrombus is meant the formation, in a vessel, of a solid mass or plug from the constituents of the blood, occurring during life. Coagulation is probably in no way responsible for thrombosis, in spite of the teaching of Wright and Knapp, who, in 1902, taught that post-typhoid thrombosis was due to the increased coagulability of the blood as a consequence of the high calcium content, following, and secondary to, the milk diet of typhoid convalescence.

The modern theory, now generally accepted, is in accord with the older theory of Eberth and Schimmelbusch. They believe that the blood-platelets play a prominent part in thrombosis and but little or no part in coagulation, while, on the other hand, fibrin and its progeners, although active in coagulation, play only a minor part in the formation of a thrombus. Blood-platelets, which, according to Bizzero, are normal constituents of the blood and number from 180,000 to 780,000 per cu. mm., are the originators of the typical thrombus. They may col-

lect about a foreign body, or, in consequence of a slowing of the blood stream, upon the damaged wall of a vessel—adhering to the vessel wall and to each other. This process is called *conglutination* and takes place only in the circulating blood, for, as Baumgarten has shown, there is no thrombus formation in the doubly-ligatured, excised vein. Following the formation of these nuclei, consisting almost entirely of blood-platelets, there is a rapid accumulation of leucocytes—mostly polynuclears—and following this, and possibly consequent to it, there is an accumulation of fibrin mixed with red cells. It is only fair to say that this theory has been disputed by competent observers, and there are still those who adhere to the original coagulation theory of Virchow, modified only by those changes which must take place in a process occurring in circulating blood. I have convinced myself, through repeated determinations, that there is no decrease in the coagulation time of the general blood in postoperative thrombophlebitis, and I have never seen any report of its occurrence in this condition.

According to Aschoff, a change in the character of the blood is a necessity for thrombus formation, while the location of the thrombus is determined by a slowing of the blood stream or by a widening of the vein, with the resulting eddy formation. To this may be added injury or disease of the vessel wall.

What changes take place in the blood? If we accept the modern theory of thrombus formation we do not have to do here with changes in the coagulation time, but with other changes less defined. Recently the viscosity of the blood has been suggested as the cause of the slowing of the blood and the consequent thrombus formation. To my knowledge the viscosity of the blood has never been tested in postoperative cases, although Bachman has shown that it is increased in infectious diseases, especially typhoid.

It has been fairly definitely proved that in those diseases in which the blood-platelets are increased thrombosis is common. In the present series the examination of the blood-platelets was made in only a few cases, and these cases are stated to show "very many" platelets. It is possible that in the future the determination of the coagulation time, the viscosity, and the

blood-platelets, if made in each case of thrombosis, may lead to important facts regarding this condition.

That chemical changes may influence the formation of thrombi has been abundantly proved. It has been shown by Sahli and Egné that thrombi did not form after the blood had been rendered non-coagulable by the injection of leeches extract, while, on the other hand, Schimmelbusch was able to cause the formation of experimental thrombi after destruction of the coagulation of the blood by the injection of peptone.

Faucheux believes that the increased sodium content of the blood, due to a temporary insufficiency of the kidney, may be a predisposing cause, and cites one case where a large experimental dose of sodium chloride was apparently the direct cause of a thrombophlebitis. His work, however, is not convincing.

The absorption of cellular material from the wound as a cause of phlebitis will be referred to later.

Given the predisposing cause in the blood, what is necessary for the formation of a thrombus?

The commonly-accepted causes are two: slowing of the blood stream, with or without formation of eddies, and localized injury or disease of the vessel wall. The blood stream may be slow from local or general causes. When the circulation in the arteries is poor it is correspondingly diminished in the veins. Physiologically the flow in the veins is much slower than in the arteries. This is especially true in veins of lower extremities.

Local causes of a slowing of the blood stream are seen in the anatomical relation of the left iliac vein and the artery and in the pressure on the veins (especially those of the pelvis) by new growths, a gravid uterus, tight clothing, etc.

These causes, together with the varicosities, so common on the lower extremities—and indeed often the result of the above conditions—without doubt account for the predilection of the lower extremities, especially the left, to thrombophlebitis. Of 98 cases in the present series, 94 were phlebitis of the lower extremities, and of these 94 cases, 81 began in the left leg.

Von Recklinghausen believes that the whirling or eddying is of more importance than the mere slowing. This motion takes places wherever the blood enters into a physiologically or

pathologically dilated portion of the vein, and is more pronounced when the general circulation is feeble. That these purely mechanical causes cannot of themselves cause thrombus formation is clearly evident, but that they can and do act as the exciting cause in many cases of thrombophlebitis is a well-recognized clinical fact.

Changes in the vessel wall may cause phlebitis. Injury to the vein without other known cause has been known to excite thrombus formation. Primary inflammation of the vein or infection spreading from contiguous tissues will excite a typical thrombophlebitis. Talke was able to cause thrombosis by the injection of staphylococci into the leg in the region of the vein, but not when they were injected directly into the vein. It seems to be the general opinion that the chronic changes associated with varicose veins, which combine several of the above-mentioned causes, are the usual exciting factor of thrombophlebitis.

However, it is unlikely that these degenerative changes are the cause in every case. If this were so, this disease should be much more common in patients past middle life, and absent or extremely rare in youth. In the present series 50 per cent. were under 40 years of age, and, what is still more striking, 20 per cent. were not over 20 years old.

Infection.—Whether each and every case of thrombosis is, or is not, infectious is a question which the limits of this paper will not permit of discussion in detail. Klein, in a recent monograph on this subject, comes to the conclusion that thrombosis is not essentially an infectious process. Whether thrombosis can occur without infection or not is of scientific interest, but it is difficult to study a large number of cases without concluding that the greater number, if not all cases of postoperative thrombophlebitis, are infectious manifestations.

Heidemann has called attention to the period of incubation and holds the entire process to be infectious in character. Klein argues against this and points to the afebrile cases as an argument against infection; but, as pointed out by Fromme, many slight rises of temperature may be overlooked, and, moreover, infection may occur without any febrile reaction whatever.

In the present series of 89 cases, 12, or 13.5 per cent., were clinically afebrile. These were generally the milder cases, the average time of confinement in bed being 15 days.

Lubarsch examined 215 cases and found that, in spite of the most exact technique, he could demonstrate organisms in only 20 cases. From this fact, and from the fact that thrombophlebitis occurs by preference in the veins of the lower extremities, Klein argues against the infectious theory of the disease. These arguments seem as futile as the argument that rheumatism and tuberculosis are non-infectious because no micro-organisms can be demonstrated in the former, and because the latter occurs by preference in the apices of the lungs.

While no definite proof can be cited for or against infection, it is impossible, after examination of a large number of records of the recognized type of postoperative thrombophlebitis, not to feel that the process is the result of one of the milder, self-limited types of non-pyogenic infection. That the infection may be initiated by mechanical or chemical factors, or both, is doubtless true, but the course and symptoms of the disease are too typical of infection to allow of any other conclusion. The blood count was not made in every case, but, when made, it was always that of a mild infection, the leucocytosis disappearing with the fever. In 30 counts made on 24 patients the average leucocyte count was 14,700 and the average polymorphonuclear count was 87 per cent.

During the period studied there occurred a total of 98 cases of postoperative thrombophlebitis (excluding those cases due to evident direct extension from contiguous inflammatory areas) in a total of 11,655 operations. These operations represent 9,814 anæsthetics—the disparity being due to the fact that on some patients two or more operations were performed during the same anæsthetic (as, for instance, appendectomy and ventro-suspension). Of these 98 cases, 94 occurred in one or both legs and are the only ones in which a detailed study is made. In 5 of these cases records are incomplete, consequently in many calculations 89 cases only are analyzed. For convenience the analysis is made under these headings: 1. Occurrence. 2. Cause. 3. Onset. 4. Duration. 5. Complications.

1. *Occurrence.*—In 11,655 operations there occurred 94 cases of phlebitis, or .81 per cent. The various operations participated in these cases as follows:

Operation.	Total number.	Males.	Phlebitis		Per cent.
			Females.	Total.	
Appendectomy	2,670	13	28	41	1.5
Inguinal hernia	1,008	8	1	9	0.9
Operations on tubes.....	676	—	9	9	1.3
Ventro-suspension	411	—	3	3	0.7
Hysterectomy	293	—	12	12	4.1
Op. on ovaries alone.....	202	—	3	3	1.5
Ventral hernia	165	0	3	3	1.8
Femoral hernia	103	0	0	0	0
Miscellaneous	6,127	6	8	14	0.23

Hysterectomy was most frequently complicated by phlebitis, with ventral hernia, appendectomy, and operations on the uterine appendages next in the order named. It is interesting to note that in 103 cases of femoral hernia no case of phlebitis occurred. This fact seems of special interest in view of the intimate relation of the femoral vein to the field of operation. Of the miscellaneous operations, 6 were laparotomies, 2 were vaginal operations, 3 were kidney operations, and the remaining 3 were amputation of the breast, thoracotomy, and incision of cellulitis of the hand.

The following is a comparative table of the cases reported by different observers:

Observer.	Laparotomies.	Thrombosis.	Per cent.
Friedman	2,766	87	3.6
Busse	1,107	18	1.6
J. Lang	1,326	19	1.4
W. and C. Mayo.....	1,788	18	1.0
Klein	5,851	70	1.2
	Births.		
Klein	34,951	76	0.12

Sex seems to have some influence on the occurrence of phlebitis. In the present series 71.3 per cent. were females. During the same period 53 per cent. of the patients admitted to the surgical divisions of the hospital were women, so that the actual percentage of female cases would be a trifle smaller. Not including the gynæcological operations, there were 40 cases in females and 27 cases in males.

Season had no influence. Each month showed from 7 to 11 cases, with no tendency to seasonable variation.

2. *Cause*.—As has been pointed out, thrombophlebitis of the leg occurs most commonly after abdominal operations, but it may follow operations on distant parts of the body. Of all operations, hysterectomy easily holds first place, probably because of the preceding pressure on the veins caused by the enlarged uterus. All of the 12 cases noted on the list followed hysterectomy for fibroids, of which there were 212 operations. Thus it is seen that phlebitis occurred in over 5 per cent. of these cases and did not occur once in 81 hysterectomies for other causes, carcinoma, prolapse, etc.). We may therefore expect phlebitis once in every twenty cases of hysterectomy for fibroid tumors.

Infection with the ordinary pus-forming organisms has been held accountable for phlebitis, but if this were true we should expect to find it exclusively a complication of operations upon purulent foci and rarely, if ever, after the so-called "clean operations." Of 94 cases, 32 had a purulent discharge, 10 were granulating, and 52 healed by primary union. Of the same cases, 40 were drained and 54 sutured without drainage (two broke down after operation). Now, working on the principle that infection at the time of operation might be the cause of the phlebitis, the cases were studied with reference to the height of the postoperative temperature. In 89 cases not markedly influenced by complications the average records are as shown below:

Postoperative temperature	Cases.	Onset. Day	Phlebitis.		Up after Days	Died
			Duration of tem- perature Days	Height of tem- perature.		
Not over 100.6°	29	11th	6.2	101.1	19.3	1
Between 100.6° and 102.5°	48	13th	7.1	101.2	19	1
Over 102.5°	12	13th	6.5	101.4	17	1

From the study of this table it is evident that the temperature after operation has little or nothing to do with the onset and course of the phlebitis.

The cases were next analyzed with regard to the length of time the postoperative temperature lasted, the cases being

further subdivided into those with drainage and those without drainage. The results are as follows:

Postoperative temperature.	Cases.	Cases.	Phlebitis.				
			Onset.	Tem- pera- ture.	Dura- tion.	Up after	Died.
			Day		Days	Days	
Lasted 2 days or less.....29	{	Drainage.....7	14th	100.9°	4	14.9	
		No drainage...22	11th	101.1°	5.9	22.4	1
Lasted 3 to 5 days.....27	{	Drainage.....10	15th	100.8°	4.8	18.3	
		No drainage...17	11th	101.1°	6.3	18.6	1
Lasted 6 days or more.....33	{	Drainage.....23	13th	101.8°	7.8	21.6	1
		No drainage...10	11th	101.4°	8.3	19.8	

It may be seen from these figures that the cases with drainage occurred from two to four days later than cases without drainage, and the cases in which drainage was employed were generally milder and ran a shorter course. This would lead to the hypothesis that the absorption of exudate from the wound predisposes to postoperative phlebitis. In other words, the absorption of the broken-down cellular elements and serous exudate, either with or without the presence of bacteria, causes such change in the blood as to lead to phlebitis and thrombosis. This interesting hypothesis is in accord with many of the known facts and warrants further study. The onset of the phlebitis is always at a period when some absorption has taken place, and usually occurs at a time when absorption is most active. In drainage cases the onset is usually later than in cases of primary union. In 9 cases in which the onset occurred on the 20th day or later, 8 cases, or 89 per cent., were drainage cases, and in 6 cases in which the onset was later than the 20th day there were no cases of primary union. The conclusion from these figures that in clean cases the liability to phlebitis is past by the 21st day, but that in drainage cases the danger of phlebitis persists for a much longer period, seems warranted.

The time of the operation, as well as the anæsthetic, seemed to have no influence on the occurrence of phlebitis or on the course or duration of the disease. The longest operation lasted 1 hour and 55 minutes, the shortest 6 minutes. Gas and ether were the anæsthetics in all but four cases, in which ether alone was used. Klein reports 560 gynæcological operations done under spinal anæsthesia with 10 cases of phlebitis, approximately the same percentage as in general anæsthesia.

Long confinement to bed has recently been brought for-

ward as the cause of postoperative thrombophlebitis. Klein claims 50 per cent. decrease since he has gotten his patients out of bed earlier. In this series 70 cases began while the patient was still in bed and 19 developed after the patient had been allowed to walk around—surely not a good argument in favor of early walking. Some cases developed even before the average date of onset in patients gotten up during first week.

3 cases developed after getting up during the 1st week.
 9 cases developed after getting up during the 2nd week.
 5 cases developed after getting up during the 3rd week.
 2 cases developed after getting up during the 4th week.

That it was not simply the getting up that called attention to the phlebitis is shown by the following:

15 cases developed within 2 days after getting up.
 2 cases developed from 3 to 5 days after getting up.
 1 case developed on the 7th day after getting up.
 1 case developed on the 15th day after getting up.

From these figures it is evident that if we are to stop phlebitis it is necessary to use other measures than merely to get our patients out of bed at an earlier date. On the contrary, the records would seem to indicate to me that the dependent position of the limbs is a factor in the causation of the process.

3. *Onset*.—The large percentage of the cases (82 per cent.) began during the second and third week. The earliest case developed on the 4th day, the latest on the 32nd day. As has been noted, the onset was earlier in the “clean” cases.

Average onset for all cases..... 12.2 days.
 Average onset for drain cases..... 13.6 days.
 Average onset for clean cases..... 11.0 days.

The period from the operation until the onset of the phlebitis has been termed, by Haidemann, the “period of incubation,” and from its constancy he argues for the infectious character of the process.

In 89 cases the onset occurred as follows:

Period before onset 7 days or less..... 7 cases.
 Period before onset 7 to 21 days..... 76 cases.
 Period before onset more than 21 days..... 6 cases.

4. *Duration*.—Of the 89 cases studied, 12 cases were afebrile and 77 cases ran a febrile course. Of the afebrile cases the shortest lasted 8 days and the longest lasted 26 days (average 15.5 days). In these afebrile cases those with drainage were regularly of shorter duration than the cases where the union was primary.

	Duration of fever.	Up after.
Afebrile cases	0 days	15.5 days
Febrile cases	7.5 days	23.2 days
All cases	6.5 days	20.0 days

Relapses were not uncommon, and, when they occurred, usually were due to the involvement of the other leg, which occurred seven times. In five of these cases the left leg was involved primarily.

5. *Complications*.—Of the complications, may be differentiated those occurring before and those occurring after the onset of the phlebitis. Of the former, nephritis occurred twice, and gonorrhœa, syphilis, influenza, and scarlet fever each developed once before the onset of the phlebitis.

Following the process, embolism occurred in 10 cases, and pleurisy (possibly embolic in origin) occurred 4 times; pneumonia, malaria, tonsillitis, eczema of the affected leg, cerebral embolism, and hæmatemesis each occurred once. It may be noted that there was no case ending in suppuration. This would hardly be the case if any of the ordinary pyogenic organisms were responsible for the process. Of the 89 cases analyzed, 3 died. One death was due to pneumonia (possibly due to embolism), one death was due to cerebral embolism, and one was due to gastric hemorrhage on the 10th day following a gastro-enterostomy and two days after the onset of phlebitis.

Except for the cases of embolism, the cause of which is well recognized, no complication seemed to bear any noteworthy relation to phlebitis.

6. *Treatment*.—The ultimate aim of all study of disease should be its prevention and cure. The treatment of post-operative thrombophlebitis has not received the attention and study due its frequency and the seriousness of its complications. Little or no attempt has been made to develop a plan

of treatment for this condition, although, reasoning from analogy, a specific medication might be obtained. Recently the advice is given to avoid phlebitis by getting patients out of bed earlier, and certain operators have reported less phlebitis since this procedure has been adopted as routine. The writer has already referred to this subject and is not so favorably impressed.

Bandaging or massage of the legs might be tried as a prophylactic, but I know of no cases where it has been practised as routine.

Wright advised the giving of lemon juice as a preventative. This was tried in four cases of the present series, but it was not given until after the onset of the phlebitis. Potassium iodide has been advised and the salicylates or citrates might be tried.

The records of the present series are given without comment. In themselves they are too few to lead to conclusions, but they may bring to light some other and better plan of treatment and at the same time cause the abandonment of less satisfactory forms of management.

The cases under consideration have been divided into several groups. In each case rest in bed was immediately insisted upon, although in some cases the patients had left the hospital and remained up and about until the swelling and discomfort brought them back to the hospital.

The other measures resorted to for the relief of the process and the course and duration were as follows:

Treatment.	Cases.	Duration of temperature.	Up and about after	Died
Ice cap and elevation.....	29	8 days	20 days	1
Ice cap, ichthyol, and elevation..	22	7 days	16 days	1
Ichthyol and elevation.....	18	6 days	16 days	1
Aluminum acetate dressing.....	6	6 days	24 days	1
Ice cap and elevation, lemon juice internally	4	6 days	18 days	0
Elevation alone	9	4 days	21 days	0
Menthol and elevation.....	1	8 days	29 days	0

In only one series was any medication given internally (except hypnotics and cathartics). Lemon juice was given in

four cases with fair results, but too few cases were thus treated to allow of any conclusion.

It was frequently noted on the history that ichthyol gave almost immediate relief from pain. The other methods were less reliable.

CONCLUSIONS.—After study of these cases I feel that the following conclusions are justified:

1. Postoperative thrombophlebitis is an infectious disease, a definite entity in some way connected with the absorption of material from the wound.

2. It is preceded by a slowing of the blood stream, and by local and general disease of the vessel walls.

3. It occurs at an earlier date in "clean" cases than in drainage cases.

4. Rest in bed seems to be the only therapeutic measure capable of exerting any marked influence on the severity and course of the disease.

5. Ichthyol seems to have a direct and constant influence on the local pain.

6. Internal medication deserves a more thorough trial than it has had previously.

Some of the above conclusions are personal, most are in accord with other observers; in them an effort has been made to bring out the salient points and to add these cases to the literature in order to hasten, if possible, the final solution of the problem.

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MULTIPLE MYELOMATA, WITH NUMEROUS SPONTANEOUS FRACTURES AND ALBUMOSURIA.

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MYELOPATHIC albumosuria is a rare disease, of which only about sixty examples have been recognized since Bence-Jones first described it before the Royal Society in 1847. Upwards of forty of these have been summarized in papers by Parkes Weber¹ and Paget Moffat,² who published their papers in 1903 and 1905, respectively, while references to the later cases will be found at the end of this article and more fully in the Transactions of the Royal Society of Medicine appended to the article by Weber and Ledingham.³

Although Bence-Jones described the characteristic albumosuria in 1847, it was only as recently as 1898 that bone lesions were recognized during the patient's life as an essential part of the disease. This was in the case of a man of 70, a patient of Dr. Bradshaw, of Liverpool. The recent exhaustive papers by Bradshaw,⁴ Weber and Moffat, together with the voluminous literature dealing with the subject chiefly from the chemical and cytological points of view, would make it quite superfluous for me to give a general review of the subject. I will therefore merely give an outline of the chief features of the disease in order that the peculiar and distinctive characters of my case may be emphasized.

It is easy to construct a simple picture of the type of disease as hitherto described, because the great majority of the cases have so very closely resembled one another. In its general characters the disease resembles osteomalacia, with which, no doubt, it has often been confused. That is to say, it is a profound constitutional affection which is accompanied by severe, deep-seated pains and bony deformity and leads to a rapidly fatal issue within a period of about two years. It differs from osteomalacia in the following respects: It affects men much more frequently than women; it presents in the urine the char-

acteristic Bence-Jones albumose; the bones are the seat of a definite cellular growth resembling a sarcoma, and are not merely softened by the absorption of the calcareous material; and the chief bones affected are the vertebræ, sternum, and ribs, rather than the pelvis and limb bones.

In many cases there has been a diminution of the red blood-corpuscles, with an increase of the white, but both these changes have only been of slight degree, and it is quite uncertain whether they are primary or secondary. Gastro-intestinal disturbances have so frequently been recorded that they must be considered as a part of the disease. In some they are the earliest symptoms, and in others they appear to be merely a late complication. Both fractures in the ordinary sense of the term and bone tumors have, in the majority of the cases, been rare or inconspicuous. This is due, no doubt, to the fact that the chief seat of the disease has usually been the bones of the thorax. In the case of Inglehart, Hamburger, and Simon⁵ a woman of 49 had a spontaneous fracture of the left femur a few days before her death. A woman of 37 (Jochman and Schumm⁶) fractured both her thighs. In Anders and Boston's second case, a man of 43 had broken his leg in a bicycle accident three years before the onset of the disease. Weber and Ledingham³ relate the case of a woman of 65 who was found at the autopsy to have a united fracture of the humerus. The case of Bruce, Lund, and Whitcombe⁸ is the only one that can fairly be described as a case of multiple spontaneous fractures. It was a woman of 51 who in 1902 and 1903 broke the left femur, left clavicle, and left humerus. In many of the other cases there occurred fractures of the ribs or sternum, which were often only discovered at the autopsy. It is thus rather curious that, although the disease is so much commoner in men than women, the latter present the majority of the cases in which fracture of the limb bones have occurred.

The case which I am about to describe is quite unique in the following respects. The length of the history is twelve years, and at the present time the patient appears to be in good health, the disease being quite stationary. Moffat² speaks of the disease as being one in which the prognosis is "utterly bad,"

there being only one case—that of Kahler—in which the symptoms had lasted as long as eight years. The majority of patients have died within two years, while many have only survived the recognition of their complaint a few months. And, lastly, the number of fractures and the development of large, conspicuous bony tumors in my patient are in marked contrast to the history of all the other cases.

Although great and minute attention has been given to the histology and chemistry of the disease, there has been very little published as to its appearances by the Röntgen rays, and I have, therefore, paid special attention to this point and reproduce here skiagrams of most of the affected bones.

History of the Illness.—Mr. P., aged 39, clerk. *Complaint.*—Multiple spontaneous fractures and swellings of the bones.

Family History.—Father alive, aged 67, has suffered from double optic neuritis for the past 12 years. Mother died four years ago from heart-disease. Lost several brothers and sisters in infancy. One brother well and robust, aged 41. Four sisters all well.

Past History and History of the Present Condition.—Twenty years ago he used to be a “perfect Sandow.” He then measured 5 feet 4 inches and weighed 8 stone.

1900.—After a period of indefinite illness, in which the doctor said he had “consumption,” an attack of gastritis occurred, with vomiting of food but not of blood; also severe pain. Weight fell to 92 pounds. He had peptonized food for six months. He completely recovered health and strength under treatment.

1901, May.—He had for some months been suffering from “rheumatic pains,” when he slipped on a banana skin and fell, breaking the *left tibia*. This took about nine months to consolidate, but otherwise there was nothing which suggested that the fracture was of an exceptional nature.

1902, January.—On raising a window sash in a railway train which was stuck fast, the window suddenly gave way and hit him on the left of the lower jaw. This was followed by a numb feeling but not much pain. A fleshy growth of the gums made its appearance near the place struck, and the jaw became gradually much thickened. The growth in the gums sprouted out cherry-like outgrowths, which from time to time were absorbed or burst, discharging thick dark blood and stringy mucus. This sometimes amounted to as much as a wineglassful at a time. The

jaw growth increased in size until 1909, but since then it has decidedly diminished and the fleshy part of the growth disappeared.

1904.—He suffered from severe "muscular rheumatism," and large bruises came out on the right thigh without any apparent cause. He was at this time very liable to fall if he encountered the slightest obstacle.

February, 1904.—The pain had been very severe in the left thigh from November, 1903, to February, 1904, when the *left femur* broke from the strain of muscular exertion. It healed in nine weeks under splint treatment.

April, 1904.—When just recovering from the last fracture, on moving to an arm chair, the *right femur* fractured. It was kept about ten weeks in splints, and was well by the end of the year.

1905.—On February 4, while getting about on crutches and swinging the left leg, the *left tibia* broke again at the old place. It was not set, but allowed to heal with marked angular displacement. This occurred in about three weeks.

February 8, 1905.—Three days later the *right forearm* broke under similar circumstances.

February 25, 1905.—While lying in bed, holding a book, the *left elbow* broke with great pain, and the present enlargement developed to almost its full size within one week.

1907.—In February the neck of the *left femur* broke when he was in bed, when he was drawing the leg up beneath himself.

1908.—The base of the *second right metacarpal* became swollen. The peculiar spatula shape of the digits he has had for a long time he attributes to the exercise of typewriting for many hours every day.

Present Condition (Fig. 1).—The patient is a very nervous and alert man, with an unhealthy, sallow complexion. Apart from his crippled condition and nervous temperament, he is healthy and cheerful. He cannot walk at all, even with crutches, because the left leg is so deformed that he cannot put the sole of the foot to the ground when standing, and the arms are so deformed that he cannot use crutches, and, further, he is naturally very anxious lest he should at any moment slip in a way which might cause a fresh fracture.

The Jaw.—The whole of the left side of the jaw is thickened so as to form a conspicuous smooth tumor. Viewed from the inside, the jaw is deeply excavated, looking as if a large medullary tumor had been scraped out from its interior. The surface of this excavated part is smoothly covered by scar tissue. The situ-

FIG. 2.



Skilgram of right forearm fracture, 1905.

FIG. 1.



Photograph of the patient taken in 1911.

FIG. 3.



Photograph of left arm (fracture 1905) taken in 1911. The upper protuberance is the dislocated head of the radius, the larger mass is a bony tumor of the upper end of the ulna.

FIG. 4.



Skiagraph of the left elbow. (Fracture 1905.)

FIG. 5.



Skiagram of the hand. Swelling of the second right metacarpal occurred in 1904.

FIG. 6.



Right femur (fractured in 1904).

FIG. 7.



Left femur. Two fractures, 1904, 1907.

FIG. 8.



Photograph of the legs. Left shin was fractured twice in 1901-1905.

FIG. 9.



Left leg and foot. Two fractures, 1901-1905.

ation of the tumor was evidently the whole left body of the mandible, and all the teeth on that side have been lost. The outer surface of the jaw mass is hard and insensitive.

The Right Forearm (Fig. 2).—The radius is the seat of a well-defined tumor, 8 x 4 cm.; rather above the middle of its shaft. The appearance of light, bubbly areas in the skiagram is well marked in the tumor, and extends up the shaft as far as the head of the bone. The ulna presents a gentle, even curve in order to accommodate itself to the mass in the radius, but, nevertheless, there is very little rotation possible in the forearm, the hand being held in full pronation.

The Left Forearm (Figs. 3 and 4).—The elbow is the seat of a great deformity. A large globular tumor 10 cm. in diameter occupies the upper end of the ulna. The radius is completely dislocated from the humerus, and its head forms the projection so conspicuous in the illustration. In the Röntgen picture the ulnar tumor is dense and remarkably well defined. The radius shows one area of expansion and thinning about the middle of its shaft which is possibly an area of disease. The elbow-joint is freely movable, though the range of its mobility is limited to about 90 degrees. Supination is impossible.

The Hands (Fig. 5).—The tips of all the digits are flattened and spatula shaped, the thumbs being most conspicuous in this deformity. There is a fusiform swelling of the second right metacarpal. The X-rays show a finely vacuolated tumor occupying the shaft of the second right metacarpal, some vacuolation without deformity in several of the carpal, metacarpal, and phalangeal bones, and marked atrophy of the terminal phalanges, especially those of the left thumb and index-finger.

The Right Femur (Fig. 6).—The right thigh is shortened, deformed, and adducted. There is a large and irregular thickening round the hip-joint, the movements of which are very much restricted. In the skiagram the whole of the head and neck of the femur is seen to be occupied by a tumor, the shadow of which has a coarsely vacuolated appearance. The upper end of the bone is bent in the shape of a crook, giving the effect of an extreme coxa vara. In the concavity of the curve is a separate piece of bone which looks as if the lesser trochanter had been detached.

The Left Femur (Fig. 7).—The head and neck are affected in much the same way as on the right side, though not to quite the same degree. Below the position of the small trochanter there is a periosteal thickening and indentation suggestive of an old

fracture. The whole of the shaft of the femur is occupied by large vacuoles, with atrophy of the dense bone, and just below the middle is a badly united fracture.

The Left Shin (Figs. 8 and 9).—The left lower leg is greatly deformed, being bent backwards almost at a right angle and having at the angle a large, globular tumor, the skin over which is marked by large veins. The X-rays show that this tumor is composed of a large portion on the tibia and a smaller one on the fibula, the whole being 13 x 10 cm. in diameter.

The Left Calcaneum (Fig. 9).—A tumor 12 x 7 cm. occupies the left heel, springing from the calcaneum and projecting chiefly on outer side of the foot. All of the tumors in the foot and leg are sharply defined, and their shadows show well-marked vacuolation.

The right tibia shows no external deformity, but in the skiagram it is evident that the whole bone is thickened, this being caused by an increase of the medullary part and a thinning of the dense part of the shaft.

The Ribs.—The sixth and eighth ribs show quite definite tumors on the X-ray plate, though these are not noticeable by palpation. Both lie just behind the angle, that on the sixth being sharply marked and about 5 cm. by 2 cm., while that on the eighth is merely a bead-like enlargement of the bone. The other bones of the skeleton are normal in their X-ray appearances.

Notes on the urine and blood by the pathologist, Dr. Scott-Williamson.—The urine, which was voided frequently, amounted to 1,200 to 1,500 c.c. daily. It contains a precipitable protein, amounting on an average of four days to 5.2 per cent., equal to 63 grammes per 24 hours. The precipitate was recovered by treating the urine with 96 per cent. alcohol and purifying by repeated solution in water containing a trace of sodium carbonate and reprecipitation by alcohol, treating with ether and drying over sulphuric acid. The ash was not estimated.

The precipitate so purified was insoluble in distilled water and only very sparingly in normal saline; readily soluble in water containing a trace of sodium carbonate. Careful neutralization keeps the protein in solution. In the presence of a trace of acid the precipitate appears at a low temperature and disappears on boiling. The temperature at which the precipitate appears varies from 60° to 43° C. as the concentration of the salt is increased. Tested with lead acetate, the precipitate contains an appreciable quantity of sulphur in loose combination. Bail's orcin test indicates the presence of a carbohydrate group in the molecule.

There seems little doubt that this protein is the "Bence-Jones body." In the urine the typical precipitation at low temperature is demonstrable, but it is impossible to appreciate any clearing upon boiling. The urine contains some casts and pus-cells and other indications of cystitis. The blood shows no quantitative or qualitative abnormalities of its cell constituents.

There can be no doubt that the above is a true case of myelopathic albumosuria, but at the same time it presents so marked a contrast to all other described cases as to form quite a separate clinical picture. The twelve years' history of his complaint may be divided into three periods. For one year he suffered from a severe constitutional illness, of which gastritis was the chief symptom; then for six years (1901-1907) he had a long succession of bone-breakings, seven times fracturing one or other of the long bones, in addition to developing tumors of the jaw, metacarpus, and tarsus. But for the last five years he has had no further developments either of fractures or tumors; he is free from pain, and, apart from his wretchedly crippled condition, he feels that he is stronger and in better health than he has been since 1900. The blood condition, as judged by the enumeration of its cells, is normal, but, on the other hand, the albumosuria remains well marked.

From a surgical point of view the case is very interesting, because it shows that the fractures, although brought about by the development of tumors of the bone-marrow, have always united firmly. His greatest disability has been caused by the neglect to retain the left leg in good position after it had broken the second time. I should be inclined to correct the angular deformity of the left leg by an open operation, but, owing to some one having suggested that this might reawaken the disease, the patient is not willing to submit to the risk.

I do not feel myself competent to discuss the essential nature of this mysterious disease, or the various pathological theories which have been put forward to explain it. Whether it is a blood disease allied to leukæmia, or a sarcoma; whether the changes in the bone-marrow are the cause or the effect of the altered metabolism, are all points fully discussed in the learned papers to which I have referred. But the case I have related seems to prove certain points quite conclusively. The whole picture is perfectly typical of an infective disease, of chronic course, attacking chiefly the skeletal tissues, and in time wear-

ing itself out and leaving nothing but the marks of its old ravages on the affected bones. First, there are all the signs of a constitutional infection, *i.e.*, a prostrating illness, severe vomiting, rapid loss of flesh, and diffuse rheumatic pains. The disease then becomes localized in the tissues most vulnerable to it, *viz.*, the bones, and these break one after another when they have been unduly weakened. But there seems to have been a good power of local reaction, and massive bone scars have been formed as the result of this local resistance to infection. And now the infection is at an end, or at least quiescent. Syphilis, tuberculosis, and actinomycosis are examples of similar diseases of known microbic origin. And, lately, other forms of sporotrichosis, chiefly affecting the bones, have been described by French authors which make it still more likely that this is really an infective disease. It is quite clear that in the ordinary clinical meaning of the term the disease is not a sarcoma. In this case, at any rate, the disease has been of twelve years' standing, and now appears to have undergone a spontaneous arrest. It seems to me quite impossible to settle this question by histological methods. It is true that many distinguished authors have positively declared that the tissue of the bone tumors is that of a round-celled sarcoma. But one may well ask whether there is any essential difference between the structures of such a sarcoma and that of the granulation tissue which is formed in reaction to bacterial infection.

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A more complete list of references may be compiled by consulting papers 1, 2, and 3.

TUBERCULOSIS OF THE BREAST.*

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My first case of tuberculosis of the breast was reported to the New York Surgical Society, May 23, 1894 (*ANNALS OF SURGERY*, August, 1894). It concerned a woman of twenty-six years on whom a radical operation was performed. When this patient was examined three years afterward the region of the scar was free, but she was in a condition of advanced pulmonary tuberculosis to which she succumbed in a short time. At the time of this original report but 34 other authentic cases could be gathered from literature.¹

My second case was published (*ANNALS OF SURGERY*, January, 1897) a little less than three years later, at which time I was able to find but four additional instances. This patient was a woman of forty years, referred by Dr. P. V. Carlin, in whom a clinical diagnosis of cancer of the breast was made; a pathological report of tuberculosis was rendered by the late Dr. H. C. Crouch. This patient remains well.

I am now able to lay before you two additional cases, making four in all. The first of these supplemental cases concerns a young woman of twenty-three years, a patient of the late Dr. J. A. Wilder. In this case a slowly growing, rather doughy mass was found in the lower outer quadrant of the left breast. A fistula which discharged thin pus was present. The breast and axillary glands were removed, together with the fascia overlying the large pectoral muscle. Smooth healing occurred. Dr. Wilder reported both breast and axillary

* Read before the Denver County Medical Society, October 15, 1912.

¹ December 7, 1912, I am this day in receipt of a communication kindly sent by Dr. Louis B. Wilson, of the Mayo Clinic, in which he says: "A somewhat careful search of our records here shows that since the laboratory was opened, January 1, 1905, there have been but two cases of tuberculosis of the breast, though during the period over one thousand cases of tumors of the breast were operated upon."—C. A. P.

glands as showing tuberculosis. This young woman was well when last seen, some three years after operation, but I am unable to find trace of her at this time.

My fourth case concerns a girl of fifteen years, a patient of Dr. P. V. Carlin. The mother of this girl first discovered a slight lumpy condition of the right breast and axilla in October, 1911. She paid but little attention to it. The condition slowly increased, fistulæ formed. The girl lost in weight and in strength. In March, 1912, she consulted Dr. Carlin, who kindly referred her to me. On examination I found a diffuse, irregular, doughy mass in the upper outer hemisphere of the right breast. The entire axilla was occupied by large, hard masses. Three discharging fistulæ were present. The breast mass seemed, clinically, to involve somewhat less than the outer upper half. The lungs were free. A thorough operation was done at St. Joseph's Hospital, March 25, 1912. Through a peripheral incision the upper outer half of the breast was removed, together with the fascia from the pectoralis major muscle. On cut section of the breast tissue it seemed as though the incision were through a healthy part of the gland, and for cosmetic reasons the inner portion of the breast, together with the nipple, was left. I am well aware that a macroscopic examination was by no means conclusive, but this operation was on a young girl and I earnestly desired to mutilate her as little as possible. The tendon of the pectoralis major was divided and the subclavian region and axilla were thoroughly cleared of a very large mass of glands. These were adherent to the vein; the dissection was difficult and tedious. The wound was closed with a cigarette drain and prompt healing took place. Dr. Ross C. Whitman, professor of pathology in the University of Colorado, makes the following histological report:

Tubercular lesions are found in the skin covering the breast, in the underlying tissues, and in the superficial portions of the glandular structure, but do not extend deeply into the gland. Where the gland is involved the lesions apparently occupy the seat of a former group of gland acini, which have been destroyed by the tubercular process. The fibrous stroma is normal. The lesions consist of groups of "epithelioid" cells and giant-cells surrounded by a zone of fibroblasts with capillaries and newly formed callagen. In and about the tubercle are remnants of glandular structure. The axillary lymph-glands are frankly tubercular.

Dr. Carlin administered small doses of tuberculin to this patient for several months after the operation. She has gained

17 pounds in weight (6 months), she has gained materially in strength, she feels well in every way. The regions of the removed breast tissue and of the axilla are free. There is no evidence of tuberculosis elsewhere. The preservation of the inner portion of the breast and of the nipple give a contour which is and will be of no little importance. I strongly feel that the entire gland should generally be removed in breast tuberculosis, but in this instance I am quite willing to run the risk of a further operation, although I doubt whether the necessity will arise. In this case it is probable that the condition first appeared in the axillary glands and extended thence to the breast.

The first notable observation on tuberculosis of the breast was made by Richet in 1880 (*Gazette des Hôpitaux*, 13 Mai, 1880). Since this article a not inconsiderable number of important contributions have been made. V. Cornil (*Les Tumeurs du Sein*, monograph, Paris, 1908) discusses the pathology in a very thorough way. He says that to the unaided eye the anatomical form of these lesions is variable. The tuberculosis may actually appear like small semitransparent granulations, often with a caseous centre and scattered over a more or less considerable portion of the gland. This type is described by Ziegler as acute tuberculosis. More commonly, however, the lesions appear as follows: On palpation, in the living subject, the gland presents one or several, more or less voluminous, superficial, subcutaneous or deep, hard nodules, at the level of which the skin is thickened and congested when the lesion is directly beneath it. These nodules are located in the gland or at its periphery, sometimes at quite a distance from the nipple. In long standing lesions an orifice may have formed spontaneously or after an incision; this granulating fistulous opening leads to a deep, purulent focus lined with fleshy granulations. A surface section shows grayish, rounded nodules composed of inflammatory tissue, semitransparent, from the size of a hempseed to that of a small pea, disseminated in a portion of the gland and caseous in their centre. These nodules are isolated, more or less distant from each other or confluent. Their caseous, yellowish centre, being lifeless, has a tendency toward disintegration,

infiltration with serum or pus, and transformation into small cavities. In cases of massed nodules the confluence of their cheesy portions and disintegrated areas gives rise to small or large irregular, angular cavities, filled with pus, their walls being lined with granulations. Under these conditions a tuberculous abscess empties through a fistula with a granulating sinus, after it has opened spontaneously through thickening and perforation of the skin, or has been punctured by the operator. The naked eye appearances, as well as the sequelæ of tuberculosis, are practically identical, no matter what organ of the body is affected, be it a gland, the testicle, the skin, or the breast. Later on there follows degeneration of all of these elements, and one or more acini with necrotic cells take on a caseous, dry appearance, due to the absorption of the liquid contained in the degenerating cellular exudate. The constituents of the latter are small, fragmentary, with non-stainable nuclei which are reduced to finely granulated nuclei. As to the formation of the giant-cells, Dubar (*Thèse de Paris*, 1881) suggests that they originate in the interior of the culs-de-sac in consequence of the accumulation of leucocytes in the glandular cavities, followed by the conglomeration of the protoplasm of these cells in the centre of the cavities. This mode of genesis of the giant-cells is very questionable. Although a large number of giant-cells are undoubtedly found in tuberculosis of the mammary glands as in all new formations of this kind in man, at the time when they are encountered the process is sufficiently advanced for the membrana propria of the gland to have disappeared. Personally, the author has never seen a cul-de-sac with a recognizable membrane containing a giant-cell, except in experimental tuberculosis of the mammary gland.

The extra-acinous milk-ducts of all sizes are involved at the same time; their peripheral connective tissue is the seat of leucocytes, their epithelial cells become larger than normal and frequently present several nuclei. This increased epithelium, mixed with the leucocytes which have passed through the membrana propria of the canal, forms a mass which fills and distends the cavity and in its turn becomes caseous. The

epithelial cells then present a hyaline protoplasm and their nuclei no longer take the stain; the leucocytes are broken up and their nuclei crumble into fine, stainable granulations, like nuclein. Tuberculous granulations project at the internal surface of the milk-ducts, the membrana propria of which is finally destroyed. These granulations possess variable numbers of giant-cells, surrounded by inflammatory tissue containing mononuclear leucocytes. The secretion of these tuberculous granulations drops into the cavity of the milk-ducts, where it collects in the form of leucocytes. The milk-ducts are changed into actual cavities with tuberculous walls. The process may be compared to the familiar course of peribronchial tuberculosis, with formation of small pulmonary cavities at the expense of the bronchioles. These small cavities give rise to progressive inflammation in their surroundings, and underneath the skin they finally invade and thin out the dermis, project under the epidermis and destroy it, opening externally and forming fistulæ or sinuses with the tuberculous walls of all subcutaneous tuberculous abscesses. In these acute and subacute cases, of a certain severity, more or less bacilli are encountered. A severe generalized tuberculosis was found by the author in the sections of a breast which had been removed by Nélaton and sent for examination as a doubtful tumor. The milk-ducts had a swollen and ulcerated internal surface and were lined with tuberculous granulations, giant-cells being surrounded by mononuclear leucocytes. In mammary tuberculosis the axillary glands are also often tuberculous.¹ This glandular tuberculosis is either subsequent to that of the mammary gland, or it may be primary, the gland being invaded secondarily. In the first case it is necessary to assume that the lymphatics have carried the bacilli or infectious agents from the breast to the glands, following the regular course of the lymph. In the second case, where the axillary glands are impermeable, the lymph is supposed to stagnate between them and the mammary gland, the infection taking a retrograde course to the breast by continuity. The histological

¹ Almost invariably—C. A. P.

examination of fully developed tuberculous nodules shows tuberculous granulations composed of a cellular tissue infiltrated with leucocytes and with giant-cells in the centre of the granulations; large cells usually surrounded by epithelioid cells. The findings differ in no way from the ordinary. Tubercle bacilli are rare. Extensive sections, in recent cases, show inflammatory irritation of the connective tissue more or less infiltrated with polynuclear or mononuclear leucocytes; in the midst of the cellular tissue are seen acini undergoing tuberculous changes. The mode of development of the lesion can be studied in these acini. When the process is very acute, the polynuclear leucocytes invade the intra-acinous cellular tissues, and later the culs-de-sac themselves where they collect between the epithelial cells and in their central lumen. In subacute invasions the mononuclears surround the culs-de-sac, which present an intact or slightly thickened membrana propria. At the same time the epithelial cells become more voluminous and numerous; soon, however, leucocytes penetrate through the membrane, destroying it and accumulating in the interior of the glandular culs-de-sac where they mix with the epithelial cells. The result is a considerable enlargement of the acini and culs-de-sac.

In mammary tuberculosis of a chronic course, the tuberculous granulations are isolated and disseminated rather than confluent, but nevertheless perfectly characterized by their giant-cells as well as by the epithelioid cells and peripheral lymphatics. Cornil examined a case of this kind operated upon by Berger; in it the blood vessels, lymphatics, and epithelial cells were at the height of their physiological activity.

Cornil received fragments of infected udders from Nocard for microscopical examination. All of the constituents of the gland were seen to be inflamed and undergoing a very active tuberculization. Although the injection had penetrated only into the milk-ducts and the culs-de-sac by which these ducts terminate in the acini, the connective tissue was invaded no less than the gland. The glandular culs-de-sac were filled with enlarged epithelial cells and with leucocytes mixed with the

milk; the connective tissue prevented the same leucocyte infiltration, and bacilli were found in the cellular tissue as well as in the contents of the glands. Later on giant-cells were demonstrated in the culs-de-sac as well as in the connective tissue.

These experiments of Nocard seem to have put an end to the controversy which had been raised concerning the development of mammary tuberculosis in women, some contending that it develops primarily in the connective tissue where it becomes localized, others claiming that it is of glandular origin and limited to the gland. From Nocard's experiment it appears that the bacilli which have been introduced into the glandular cavities subsequently spread outside of these; it cannot well be otherwise when the connective tissue is the primary seat of the infection.

Recently an analogous experiment was performed by Nathan Larrier, who injected a small amount of a virulent culture of tubercle bacilli by means of a Pravaz syringe into the middle of a nursing guinea pig's udder. He injected, without distinction, the cellular tissue or the glandular parenchyma, or both together. The warm milk in the gland, at the instant of its production, was found by him to be the best and most rapid culture medium for the bacillus. At the end of eight to ten days the microbe was recovered from the secreted milk, and on the twelfth day the histological examination showed the presence of tuberculous lesions of the gland. Nathan Larrier concludes from these findings that the inoculation of a liquid that is suspected of being tuberculous into the udder of a nursing guinea pig is the most rapid method of diagnosis of tubercle bacilli. As a matter of fact, a positive or negative outcome is obtained at the end of at most ten or twelve days, while it is necessary to wait a month after subcutaneous or interperitoneal inoculation of the same animal.

Abraham (*Tuberculose Primitive du Sein, Thèse de Paris, 1910*) says that tuberculosis of the breast is a relatively rare disease which attacks women from puberty to the menopause. The personal antecedents of the patient, pregnancy, lactation,

preceding diseases of the breast, occupy an important place in the etiology of the mammary tuberculosis, which in certain cases may represent an isolated and primary manifestation of the disease. The infection may occur by the blood route, by the lymphatic route, or by way of the milk channels.

From the anatomical as well as clinical point of view, mammary tuberculosis appears under two principal forms: the disseminated and the confluent. The latter is by far the most common. Between these two extreme types various intermediate forms may come under observation. While the diagnosis is not especially difficult in certain cases, it may become practically impossible in others. The condition may be confused with any solid or liquid tumor of the breast. The prognosis as to life is variable, but the gland itself is generally doomed. When tuberculosis of the breast attacks an individual already suffering from visceral lesions, the prognosis is governed by the general condition. When, on the other hand, tuberculosis of the breast is the only manifestation of the disease, it is not likely to lead to a very rapid infection of the organism.

An interesting observation is made by Duvergey (*Journal de Médecine de Bordeaux*, No. 53, 1911, p. 841), who presented before the Bordeaux Anatomo-clinical Society meeting of October 23, 1911, a case of mammary tuberculosis, by retrograde lymphatic infection in consequence of an infected wound of the hand, in a woman forty-eight years old. The patient's left hand, which had a small abrasion at the dorsal surface of the second metacarpal bone, became infected with tuberculous material in the handling of contaminated bed linen in a sanitarium. Some months later, after having lost considerably in weight, the patient began to suffer from a large axillary abscess; this was followed by the appearance of an abscess of the breast with supra- and subclavicular abscesses. The tubercle bacillus had accordingly penetrated through the wound of the hand, infecting the axillary glands by the lymphatic route and giving rise to a local tuberculous adenitis; continuing along the lymphatic route it led to the formation of abscesses

in the integument and superficial portions of the mammary gland; next, the supraclavicular glands became infected and began to suppurate; finally the apex of the left lung was invaded, perhaps also by the lymphatic route.

Tuberculosis of the breast is known to occur by way of the lymphatics, the starting point being in the axillary glands; the above observation belongs under the same heading.

Ingier (*Mastitis tuberculosa obliterans*, Virchow's *Archiv.*, vol. ccii, 1910, p. 217) reports a case of tuberculous mastitis in which obliteration of the excretory ducts of the mammary gland had occurred through intracanalicular tuberculous granulations. Tuberculosis was at once suggested by the peculiar structure of the granulation tissue and the appearance of Langhans's giant-cells. This assumption was confirmed by the demonstration of tubercle bacilli in the smear specimen of fresh material.

Although primary tuberculosis of the breast has been described in numerous cases it is generally considered a relatively rare disease of that organ. Bindo de Vecchi, in 1902, contributed a critical review of the cases reported up to that date (*Extratis della clinica chirurgica*, No. 8, 1902). Including a personal observation, he found altogether 78 cases of primary tuberculosis of the mammary gland. None of these cases seems to have been due to intracanalicular tuberculous inflammation leading to obliteration of the excretory ducts, as in the author's observation. A second case of mastitis tuberculosa obliterans was observed by him a short time later, while a third case represents a more fibrous form of mammary tuberculosis.

Stromberg and Kasogledow (*Tuberculose der Brustdrüse*, *Russ. Archiv. für Chirurgie*, 1909; *Jahresbericht für Chirurgie*, xv, 1909, p. 526) give three forms of tuberculosis of the mammary gland: the diffuse, confluent form, solitary cold abscess, and the sclerotic, scirrhus-like form. The diagnosis of the last named form meets with difficulties, because the pieces obtained by an exploratory incision can hardly be differentiated from carcinomatous scirrhus in the histological

examination.² In at least 50 per cent. of cases the mammary gland is not alone affected, there are other foci of tuberculosis.

Braendle (Ueber die Tuberkulose der Brustdrüse und die Dauerresultate ihrer operativen Behandlung, *Beiträge zur klin. Chirurgie*, vol. 1, 1906, p. 215) reports on eleven patients who came under treatment in the Tübingen surgical clinic, service of von Burns. All had borne children and seven had nursed them. None of these patients had a demonstrable affection of the lungs; two had tuberculous lymphomata other than axillary, while the axillary glands were involved in 85 per cent. of the cases. The confluent form of mammary tuberculosis was represented throughout. In ten of the cases amputation of the breast with evacuation of the glands was done, the wounds healing smoothly within from 8 to 14 days. One case healed under excochleation and drainage. Concerning the permanency of the cure, the author was enabled to investigate 16 cases. These cases included 15 cures; there was one recurrence in a case which probably originated in a costal caries. The period of observation comprised from 1 to 19 years. Three patients who had remained free from local recurrence died from pulmonary phthisis. Subsequent infection of the other breast was not observed in any instance. According to these experiences, with a figure of 92.75 per cent. permanent cures, the prognosis of mammary tuberculosis is designated by the author as favorable. The assertion appears justifiable, that in comparison with tuberculous affections of other organs tuberculosis of the breast must be regarded as a relatively benign disease, when submitted to radical surgical treatment.

A further report of five personal observations is made by Mantelli (Morgagni, March, 1910, Part I, p. 98). Three of these were of the disseminated type and two of the confluent type. The last two patients were treated by amputation of the breast with evacuation of the axilla. The treatment of the first group consisted in resection of the affected areas. The

² My second case may well have been of this variety—C. A. P.

outcome in all cases was favorable. Two of the patients treated by resection had been well for two and three years, respectively, at the time of the report.

As regards the management of this condition Schley³ (ANNALS OF SURGERY, April, 1903; St. Luke's Hospital, Med. and Surg. Reports, 1910) tabulates the following procedures:

(1) Curetting of sinuses; (2) cauterization of sinuses; (3) injection of sinuses and cavities; (4) incision or aspiration of abscesses; (5) removal of the tumor alone; (6) removal of the axillary glands alone; (7) removal of the tumor and a portion of the breast; (8) removal of the breast and tumor; (9) removal of the breast and axillary glands.

Of these the classical operation must be the thorough removal of the breast, pectoral fascia, and axillary contents. The axilla should invariably be evacuated, and it will be found that the glands therein are almost always tuberculous. Exceptionally, as in the fourth case of my own series, one may content himself with removal of the affected portion of the breast, the underlying pectoral fascia, and the axillary glands. In very exceptional instances, as in patients with advanced pulmonary tuberculosis, one may resort to some other of the procedures enumerated by Schley.

* An admirable contribution containing a complete bibliography.

ANGULATION OF THE JUNCTION OF THE HEPATIC AND COMMON DUCTS AFTER CHOLECYSTO- TOMY, SIMULATING COMMON DUCT OBSTRUCTION.

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ON several occasions the writer has been rather puzzled by observing that, after a comparatively simple cholecystostomy for gall-stones, when it was apparently obvious that the bile-passages were completely cleared of calculi at the operation, either the biliary fistula persisted, or, if it closed, symptoms of biliary obstruction,—jaundice and colic,—developed. Under the impression that an incomplete operation had been performed and that one or more stones had been left in the common duct, a second operative attempt would show that the choledochus was entirely free of stones, that a sound could easily be passed into the duodenum after choledochotomy, and that after cholecystectomy, or even after freeing the gall-bladder from the abdominal wall, closing it and dropping it back into the abdominal cavity, the patient would make an uninterrupted recovery. To satisfy one's conscience, that euphemism "adhesions" would be advanced in explanation of these incongruities. In discussing the question with several of my colleagues, I learned that they have had similar experiences, and that they were at quite the same loss to explain the problem as I was.

Very recently I was able to make most accurate observations on such a case.* I am convinced that these observations explain many of my previous experiences, and I also believe that they constitute a very potent argument against cholecys-

* Patient present at the Surgical Section of the New York Academy of Medicine, November 1, 1912.

tostomy and for cholecystectomy. I also believe that the complication of cholecystostomy depicted in the following case is by no means uncommon and deserves serious consideration when this operative procedure is contemplated.

E. S., female, married, age 19 years, admitted to the surgical service of the German Hospital, July 20, 1912.

Patient has one child, five months old.

For two months she has had frequent attacks of cramp-like pain in the right hypochondrium. The pains radiate to both sides and also to the right scapula. With the severe attacks there has been nausea and vomiting. There has been slight jaundice after the severe attacks. She has lost considerable weight in the past three months. Her appetite is poor and her bowels are constipated. She has never noticed any stones in her stool.

Status præsens.—There is decided tenderness and some rigidity in the right hypochondriac region. There is a slight subicteric hue to the conjunctiva. There is no distinctly palpable tumor. Temperature 100.2° F. Pulse 84. Respiration 20. Urine contains bile, and the stools are light in color.

Diagnosis.—Subsiding cholecystitis. Calculi in the gall-bladder.

Operation (July 24, 1912) *by author.*—Longitudinal incision through right rectus. Gall-bladder large, slightly congested, but walls not thickened. Gall-bladder aspirated at fundus, slightly viscid bile. Gall-bladder opened and five medium-sized stones removed. Ducts carefully palpated and found empty. An attempt to bougie the choledochus through the gall-bladder was unsuccessful. As the gall-bladder was not much diseased, a cholecystostomy was performed by inverting the opened fundus of the gall-bladder over a drainage tube by means of a Lembert purse-string suture. The gall-bladder was then fixed to the parietal peritoneum by several sutures. It is to be emphasized that the gall-bladder was neither shrunk nor retracted, and that its fixation to the abdominal wall was accomplished without the slightest tension. A gauze drain was placed below the gall-bladder, and the abdominal wound, except for the drainage opening, was closed in layers.

The patient reacted well after the operation, and there was a free drainage of bile through the tube.

August 1, 1912.—Tube and gauze drain removed. Small gauze tampon inserted.

There was a prompt stoppage of the biliary drainage. There was a mucopurulent discharge from the wound.

August 9 to 16, 1912.—Frequent attacks of severe colicky pains. Evident icterus. Acholic stools.

August 17, 1912.—Reopening of gall-bladder wound at dressing, by forcible insertion of dressing forceps into sinus. Profuse biliary discharge. The discharge of bile continued, the stools

FIG. 1.

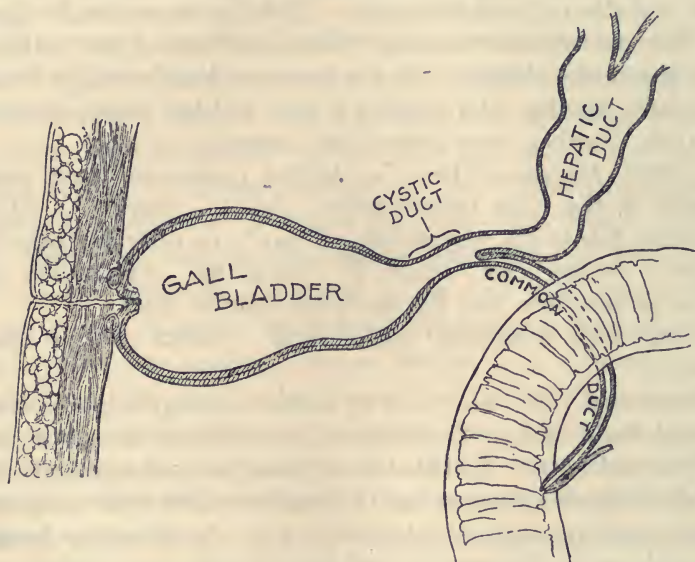


Diagram showing angulation of the junction of the hepatic and common ducts after cholecystostomy. Note dilatation of the hepatic duct and valve-like formation at junction of hepaticus and choledochus.

were clay colored, and it was apparent that there was an obstruction to the flow of bile into the intestine. It was assumed that the original operation had been an incomplete one and that there was now one or more stones in the common duct. Operation was decided upon and performed by the author on August 24, 1912.

Second Operation.—Incision through old scar after curetting and tamponing sinus. The contracted gall-bladder was freed down to the cystic duct. *No stones* were felt in the gall-bladder or in any of the ducts. A kinking of the junction of the hepaticus and choledochus was found. The angle formed by the junction

of these two ducts was less than 45 degrees. After ligation of the cystic artery, the gall-bladder was removed. The stump of the cystic duct was then split upward into the hepatic and downward into the common duct. Though there was a valve-like formation (Fig. 1) at the junction of the two ducts, a large probe was easily inserted into the duodenum and also upward into the hepaticus, which was dilated. No sign of a calculus. A tube was inserted into the hepatic duct for drainage and sutured in place. One gauze wick was led to the opening in the ducts and another to the bed of the gall-bladder. Wound, except for drainage opening, closed in three layers.

The reaction after the operation was rather severe, but after 24 hours the patient began to make a prompt and uneventful recovery. The drainage through the tube was not good, but the dressings were constantly soaked with bile.

August 30, 1912.—Drainage tube and gauze wicks removed.

The flow of bile began to decrease at once. The stools were well colored and the wound healed rapidly. There was no recurrence of the colicky pains.

September 9, 1912.—The wound is almost closed. There is very slight biliary drainage. The stools are normal. There is no pain. The patient is out of bed.

September 10, 1912.—The wound is closed and the patient is entirely cured of her gall-bladder condition.

September 28, 1912.—Discharged cured.

An epicritical review of this case must lead us to the following conclusions: After a simple cholecystostomy done in the most approved fashion on a comparatively normal gall-bladder, which was not in the least retracted and which was fixed to the peritoneum of the abdominal wall without the slightest tension, a symptom-complex develops which most strongly suggests the presence of a stone in the common duct. On relaparotomy no stone is found, but it is seen that an angulation has developed at the junction of the hepaticus and choledochus. At the angulation a valve has formed so that the flow of bile into the intestine is almost impossible. Hence the pain and jaundice when the biliary fistula was closed and the tendency toward persistence of the fistula after it was reopened. Though there was no tension originally when the

gall-bladder was fixed to the abdominal wall, there must have been a decided contraction of that organ after the first operation. This contraction, probably aided by the pull of the respiratory movements, resulted in the angulation. The condition was promptly cured by cholecystectomy, which permitted the angle at the junction of the ducts to straighten out.

A careful perusal of the literature of gall-bladder operations shows that this complication of cholecystostomy has been more or less overlooked. To be sure most of the text-books mention the persistence of a biliary fistula after cholecystostomy according to the old technic when the gall-bladder was fixed to the skin and "Lippen" fistulæ were common. Kehr on several occasions mentions in most general terms that occasionally very disagreeable distortions of the biliary tract may follow cholecystostomy, and even in his excellent review at the Second International Surgical Congress he is no more specific. Only in his text-book on gall-stones, published in 1905, does he really definitely suggest the possibility. In speaking of the causes of biliary fistula after cholecystostomy, he says: "The fixation of the gall-bladder to the parietal peritoneum may produce too great a tension on that organ and on the choledochus, so that the flow of bile into the intestine is impeded. This was a common occurrence when the technic of gall-bladder surgery was in its infancy. If the gall-bladder is pulled too forcibly to the parietal peritoneum for the purposes of fixation, or if the fundus of that organ is sewed to the muscle or skin, one need not be surprised if a permanent biliary fistula is the result. With good technic these fistula can *always** be prevented. One must not put too great a tension on the gall-bladder, and small, contracted gall-bladders must not be sewed to the peritoneum at all. They should be drained by the tube method or, better, excised. . . . One must avoid all tension, one should sew the gall-bladder as high up as possible in the abdominal wound, and one must always remember that a secondary shrinkage is possible. The less frequently one performs cholecystostomy the less frequently

* *Italics mine.*

will one have to deal with biliary fistulæ. Cholecystectomy is the best means to prevent a biliary fistula, and likewise the most radical method of curing an existing one." Kehr also publishes a diagram that in some respects resembles my illustration, which was made from a sketch of my own, drawn immediately after the operation.

As will be seen, Kehr attributes this complication to improper technic in the performance of the cholecystostomy. I believe it is perfectly possible for it to be due to the operation, *per se*, with the observance of the most accepted technic. Kehr believes that this distortion of the ducts can only occur if too much tension is put on the gall-bladder at the primary operation, as, for instance, by sewing, forcibly, a contracted or retracted gall-bladder into the abdominal wound. I am convinced that it may occur by secondary shrinkage and respiratory pull when the anatomy and location of the gall-bladder are entirely satisfactory at first and when the gall-bladder is sewn to the peritoneum without the least tension primarily. I agree absolutely with Kehr that a certain means of preventing this angulation of the hepaticus and choledochus junction is primary cholecystectomy.

Of course, if one uses what Kehr terms the "tube method," dropping the gall-bladder back into the abdomen, the chances of kinking are greatly reduced. Still the sinus itself may contract and the method, in my opinion, is not one of choice. Leakage into the peritoneal cavity is, at least, theoretically possible, even if, practically, this danger is minimal.

To avoid this angulation of the junction of the ducts ideal cholecystotomy might be performed in the type of case under consideration. The advantages of this operation are very questionable, however. The calculous gall-bladder is inflamed and requires drainage, if it is not removed; the danger of recurrence is greatly increased if the gall-bladder is left in and is not drained; stones that may have been overlooked can escape through the drainage opening if one exists; finally, the possibility of leakage of the gall-bladder suture must also be considered.

STRANGULATED INGUINAL HERNIA IN EARLY INFANCY.

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THE preparation of this paper was undertaken with a three-fold purpose: (1) of placing on record a case of the writer's in keeping with the subject; (2) of assembling cases reported in the literature; and (3) an examination and discussion of the literature, limiting discussion to cases occurring in infants under six months of age.

The youngest case on record, operated upon for this condition, appears to be that of Woodbury's,⁶⁸ operated by Andrews in August, 1874. The child was 45 hours old when the strangulated right inguinal hernia demanded operation. At the end of this time the hernia was the size of the child's head. Ether was used as an anæsthetic. The neck of the sac was relieved by knife and dilatation by the fingers. The tumor contained the greater part of the large intestine. Complete recovery followed operation.

White,⁶⁴ Stern and Burnier⁵⁶ report each a case operated at 11 days of age. Bull and Coley's report contains one case at 13 days.

McLaurin,⁴¹ in 1900, reported a case of strangulated right inguinal hernia, operated by him in the Prince Alfred Hospital, Sydney. The child was 14 days old when operated, and the hernia had been strangulated for 36 hours. He did not stop to make exact differentiation of the parts in his case. Recovery followed operation.

Stiles⁵⁷ and Goinard²⁷ each reports one case operated at 14 days. Jopson reports a case operated at two weeks, in which the strangulation had been present 24 hours.⁸¹ Carmichael¹² also reports one case operated at two weeks; Estor²⁵ one at 15 days, and Dun²³ one at 17 days.

The writer's case (operation at 18 days old).—On the evening of June 24, 1910, the writer was called to see a male child, weight $4\frac{1}{2}$ pounds, emaciated and illy-nourished. Although breast-fed up to this time, the child's stools, according to the mother's statement, had been green and foul-smelling since birth (June 6, 1910). During the afternoon the mother had administered a glycerine enema. This was returned, accompanied by blood and mucus and a few bits of feces, and the babe vomited yellow fecal contents of the upper intestine. Examination revealed double inguinal herniæ—both being down at the time. The one on the right could be completely reduced by moderate manipulation, but the left one could be but partially reduced. Fearing injury to the gut from too vigorous and prolonged efforts at taxis, and in view of the fact that a dose of castor oil had been given, the mother was advised to keep the babe quiet as possible, the tumor under slight pressure, the head somewhat lower than the feet, and to call assistance if needed before morning. The tumor at this first visit was about the size of a large English walnut.

At five o'clock the next morning the babe was again seen. Stercoraceous vomiting had been repeated. There had been no further dejections, and the left hernial tumor was larger, hard, tense and blue with congestion; tympanites increased and the little infant visibly exhausted. No reduction of the tumor could be obtained. The right one was easily reduced.

The infant was now removed to the hospital, where, less than two hours later, the infant was given chloroform, and an attempt again made to reduce the tumor by taxis—the child's body being held head-downward—but the attempt was a failure. Accordingly the hernia was cut down upon. The tense, congested gut showed through the almost transparent peritoneal sac. The latter was opened and the gut examined for signs of gangrene. None presented. The inguinal ring was, by means of forceps and a nick at the upper edge, dilated sufficiently to draw out a few inches of the abdominal gut for inspection. Circulation in the congested portion was reëstablished by hot compresses and the gut returned to the abdomen. Closure of the wound was a very uncertain consideration, owing to the frail structures. Muscles and fascia were stitched over and over as securely as possible with No. 1 chromic catgut and the skin with a running suture of the same. No attempt was made to transplant the cord. A thick pad of gauze.

wrung out of boric and alcohol solution, was placed over the wound and supported by a napkin pinned tightly in place. The babe was returned to the nursery, placed in warm blankets and surrounded by hot-water bags. Respiration was imperceptible, and no pulse could be felt. A drop of brandy on the tongue, artificial respiration, and strychnine sulphate gr. 1/300 hypodermically were administered, and in ten or fifteen minutes the babe was breathing independently and crying soon afterwards. At 11.30 A.M. (about 4 hours after operation) a profuse, foul-smelling dejection occurred voluntarily, containing a few streaks of blood. This was the last blood seen. The stools gradually regained a normal color and odor. Artificial feeding was begun at once, and the babe gained $1\frac{1}{4}$ pounds during its stay of two weeks in the hospital. The wound was kept clean by fresh dressings of gauze wrung out of boric and alcohol solution at each change of napkin. Healing was by first intention.

Two or three times during the first 48 hours and once on the third day a small bulging presented beneath the lower end of the wound during crying spells. This was reduced and held in place by counter-pressure, and thereafter no recurrence of hernia occurred. The babe was continued on a modified formula of malt soup and cow's milk and gained steadily, weighing, at 3 months of age, $8\frac{1}{2}$ pounds—a gain of 4 pounds.

In this case the babe was first seen on the evening of the 17th day of life and operated on the morning of the 18th day. When the child left the hospital the mother was cautioned to carefully watch for any recurrence of the hernia on the unoperated side, and also cautioned against allowing the child to become constipated. The operation was done primarily to save life and not primarily for radical cure of the existing herniæ.

Kirmisson³⁸ reports a case operated at 18 days with recovery.

Another case on the 18th day is reported operated upon by J. L. Sagerson,⁷⁰ Johnstown, Pa. The case is recently quoted by Murphy. Fecal vomiting and an empty lower bowel were present. The child was removed to the hospital and the first incision made without anæsthesia. After release of the constriction, the child's condition seemed to be easier and

chloroform was administered. The appendix was found within the hernial sac and removed. The child was allowed to nurse on the second day. Good recovery followed operation.

Bidwell ⁴ cites a case in which he operated at 19 days.

From the 27th day to one month several cases are reported by English, French, and American writers, notably Bilhaut,⁵ Thomson,⁶¹ Whitacre,⁶³ Reed,⁵¹ Stretton,⁵⁸ and others.

From one to six months the recorded cases are relatively less numerous. Telford ⁵⁹ collected 112 operated cases up to six months of age and tabulates them as follows:

Age in months.....	1	2	3	4	5	6
Number of operations.	34	27	24	12	6	9—112

Kirmisson ³⁸ quotes Mayer, who collected 105 cases, 72 of which occurred under six months of age and 33 between six months and one year. He quotes Pettijohn also (Paris, 1899), who collected 59 cases six months or under, and 22 cases six months to one year.

The table below is given for the purpose of illustrating the manner in which the cases decrease in number up to six months of age:

	1 mo	2 mos.	3 mos.	4 mos.	5 mos.	6 mos.	Totals.
Mayer	18	17	16	9	5	7	72 cases.
Pettijohn	15	17	9	5	5	8	59 cases.

Etiology and Occurrence.—Judging from the large number of herniæ found in adults, and from those we are accustomed to regard as congenital, it seems very reasonable to state that strangulated inguinal hernia, at a very early age, while not an exceptionally rare occurrence, is still comparatively so, though in the last few years case reports are becoming more numerous. Undoubtedly the cases we never hear of are those in which the symptoms of strangulation are attributed to colic by the mother or nurse.⁶²

In reviewing the histories of 15,000 cases of inguinal hernia in adults, Coley found that about one-third of them had had hernia in infancy or childhood.⁶⁵ Carmody says not $\frac{1}{2}$ of 1 per cent. of the cases of hernia occurring in infants become strangulated.

Estor,²⁸ writing in 1903, says that strangulated inguinal hernia is rare

in infants, but not the exception. He also observes that during his work of collecting some 225 cases of strangulated herniæ of all kinds, under two years of age, he found that in nine of the largest clinics in Europe the records showed not a single case operated upon. He further estimates the relative frequency of strangulation in children to that in adults as 1:62. Frickhoffer²⁵ estimates it as 1:107; Stern as 1:108.

One hundred and twenty, or one-half of Estor's cases, occurred within the first six months. (This, of course, includes umbilical and femoral herniæ.) In ten cases no hernia had been noticed up to the time of strangulation.

Broca⁷ states that strangulation under one year is more common than later.

Moynihán's tables¹²—quoted by Carmichael—show strangulation to be most common during the first month of life and gradually less frequent up to one year.

It is probably true that there has been a tendency to underestimate rather than to overestimate the number of cases calling for operation.²⁴ McLaurin suggests as an explanation of the relative rarity of these cases the softness of the structures at the neck of the sac, making the pinching down upon the gut in an existing hernia an unusual occurrence. Estor, also, states that the rarity of the accident of strangulation is perhaps explainable by the feeble resistance of the tissues which form the sac of the hernia.

Coley,¹⁶ on the other hand, saw but one case in which he believed the strangulation was due to the neck of the sac. In all other cases he explained the strangulation by tightness at the external ring. He thinks the neck of the sac is not the cause of the constriction.

Broca observes that children, up to one year or 18 months, with backward physical development, present conditions predisposing to hernia.⁷ He gives as the predisposing causes rachitis, malformations of the peritoneum, and prematurity. Paternal heredity seems to be a notable factor. Many children are born with a hernia already formed and frequently containing a portion of the large intestine. Moreover, illy-nourished children show no tendency to spontaneous cure, but the condition is more and more aggravated by crying and straining, bringing about, as it were, a vicious circle of ill-nourishment, fretfulness, and aggravation of such herniæ as may exist.

It is quite noticeable that we find very little mention of adherent or incarcerated herniæ in infants. This is probably explained by the fact that the hernia has not existed sufficiently long to become adherent in its abnormal situation. E. Cordier, however, cites a case of double inguinal irreducible hernia found in a child at term.²⁷ Herr (Wetzlar) reports a case of incarcerated inguinal hernia in a child three months old, and mentions two cases operated by Klaussner (Munich), one at six weeks and one at four months.²¹ It is interesting to note that in 10 or 15 cases of Kovacs's, in which he had operated in later childhood for sudden recurrence of hernia treated by truss and supposed to be cured, he found evidences of incarceration in over one-half of the cases.²⁹

The symptomatology in children differs from that in the adult chiefly upon the absence of subjective evidence and the tendency to more rapid collapse. The objective symptoms are nausea, vomiting, constipation, or obstipation, tenesmus, local tenderness, swelling, hernial tension, blood and mucus per rectum, variations in pulse from the quick hard variety, followed later by the wiry, small, weak, and more rapid variety. The face, depending upon the patient's general condition, may be flushed with fever or pallid, as in shock, pinched and drawn.⁶⁵ The cardinal symptoms more peculiar to infants are violent and uncontrollable screaming, recurrent vomiting (often fecal in character), tendency to retention of the urine and constipation, facies suggesting shock; also a great tendency to rapid collapse.³¹

Contents of the Sac.—These are most frequently the small intestine or portions thereof, though not infrequently the cæcum and appendix are found. Estor observes that the appendicular and cæco-appendicular varieties are more frequent than in adults.²⁵ Stiles found the cæcum in the hernial sac in 7 per cent. of his cases. The cæcum is more mobile in children than in adults.⁵⁷ He regards such cases as more liable to become irreducible, incarcerated, or strangulated. In Telford's 104 cases the small intestine was found in the sac in 83 cases; the cæcum and appendix in 21 cases.⁵⁹ In Estor's 225 cases the appendix or cæcum and appendix appeared in the sac in 17.²⁵ The omentum in infants is ordinarily not developed sufficiently to be found in the sac.

Diagnosis.—The diagnosis presents few difficulties, and these chiefly in comparison with the diagnosis in adults. An accurate history is of the utmost importance. In the presence of vomiting, especially if of stercoraceous material, in the absence of stools, the presence of pallor, sunken eyes, the possible retention of the urine, and, very rarely, the symptoms of early peritonitis, one should be fairly sure of the diagnosis. Herr makes a special point in emphasizing vomiting, pinched or drawn countenance, and the absence of stool, in establishing a diagnosis. An inflamed ectopic testicle should also be con-

sidered. The possibility of an acute hydrocele must be considered as well, and an effort made to rule this out in making a diagnosis.

In the Stern and Burnier case a diagnosis of strangulated inguinal hernia was first made on the 10th day of the infant's life. Upon further examination the diagnosis was changed to hydrocele. The symptoms soon took on a serious aspect, however, and the operation was done 30 hours after the appearance of the tumor. Operation revealed a gangrenous gut with two perforations, due to strangulation. Artificial anus was made and the infant recovered. This case serves to illustrate the rapidity with which the infant intestine may go on to gangrene, the possible non-appearance of alarming symptoms until gangrene and perforation may be present, and also the unusual recuperative power of an infant having sustained a serious operation. Gangrene may take place in one hour, or it may not take place for 24 hours or more.⁶⁴ It should be borne in mind that hernia in a young infant may be quite translucent.¹⁵ Clogg cites two cases, in one of which the hydrocele was tapped and a complicating hernia discovered.

Prognosis.—In general, authorities are agreed that the prognosis in these cases is good in proportion as the diagnosis is established early and the case operated upon promptly. Dun makes the statement that the older the child the shorter duration of strangulation, and the less prolonged efforts at reduction by taxis the better the prognosis.²³ Bidwell is inclined never to give a bad prognosis, owing to the fallacy of the belief, in past times, that it was not possible to operate without a large percentage of infected cases.⁴ While infants show a great tendency to collapse during the state of strangulation, it is noticeable that, with the relief of the strangulation, they recover very rapidly and quite satisfactorily.⁴ Reid (J. A.) believes the prognosis depends upon the duration of strangulation and the amount of damage done by taxis previous to operation.

As to operation at a very early age, Stiles, in speaking of cases not strangulated, observes that if he were asked at what

age to operate he would say "just before teething." Of his operations for radical cure 26 per cent. were under 12 months old. Lucas also advocates early operation for radical cure, and discourages the use of the truss.⁴⁰

Mortality.—Unfortunately, all the cases reported in the literature are not supplemented by a statement concerning the recovery or death of the patient. The opinions of various writers tend to establish the fact, however, that the mortality should be much less in infants with strangulation, if properly cared for, than in adults. Most of the mortality is due to waiting. Taking the cases as they run, the tables, according to Estor, show an aggregate mortality of 23 per cent. Authorities are agreed that this should be very much less. Coley considers that the mortality should be considerably smaller than that in adults. In his 17 cases operated there were no deaths. Dowd believes that the mortality should be not to exceed 10 per cent. when operation occurs promptly.²² Reid (W. B.) believes that were these strangulated cases in infancy operated under aseptic conditions and early, before they had been maltreated by taxis, the mortality need not be more than 3 per cent. Reid (J. A.) believes that the mortality should be less than 1 per cent.

Treatment.—Mistakes are made, either in prolonging efforts at taxis or in instituting too vigorous taxis. Rough handling of the hernial tumor is a dangerous procedure.³¹ The child is not able to tell you how much pain you are causing, as the adult is. Moreover, taxis, if one has a case of strangulation, is seldom rewarded by reduction of the hernial tumor. This places upon the operator the responsibility, therefore, of being prepared to operate at the same time he makes his preparations leading to the anæsthetization of the child for the purpose of reduction. It is almost axiomatic that, with the failure of reduction by taxis, operation is imperative. It is not taking too broad a step to assert that the operation should be as nearly immediate as is possible. There is no other method of dealing with the condition other than operation, which gives promise of results which are nearly as good.²² In the absence of reduc-

tion by taxis, with prolongation of strangulation and its attendant symptoms, the child will most assuredly die if not relieved by operative interference. The ultimate result of strangulation is gangrene.

Operative Methods.—Having established a diagnosis and being prepared to operate, the question of anæsthetic presents itself. The greater percentage of the cases reported have been given chloroform. This may be in accord with custom at the various times in which the reported cases were dealt with; or it may be due to a more or less prevalent belief that infants and children should have chloroform rather than ether. Herr, in his case, used ether-chloroform. One operator made his original incision without any anæsthetic, and later in the operation gave chloroform. The writer has found no cases reported in which a local anæsthetic was used. In one case reported by Guion no anæsthetic was used throughout the operation. In the present day, with the almost universal use of ether, it is probable that this will be the anæsthetic of choice. Children take it well, and it requires very little more time than chloroform to administer. Dowd believes it is much better than chloroform for this class of cases.

In discussing the administration of anæsthetics to children at the New Jersey State Medical Society, 1912, Tuers said: "There are practically but two anæsthetics to be considered—chloroform and ether. We should administer the least dangerous drug in the least dangerous way. Chloroform is the pleasanter of the two, but the more dangerous."

The choice of operation is not a momentous question. A simple, time-saving operation is essential. It would be folly to attempt a too extended operation, consuming much time, when dealing with an exhausted infant requiring operation for strangulation. At the Mayo clinic they have found it unnecessary to transplant the cord in young children. Coley and others follow this procedure. Cumston, after reviewing the various methods of operation for inguinal hernia in children, and considering those of Kocher, Broca, Macewen, La Dentu,

Magnai, Ball, Barker, Lucas-Championniere, Kirmisson, Russell, Froelich, Folizet, Gaudier, Cooper, and others, believes that the Bassini is the best for a rapid, simple, and at the same time thorough operation. Dowd also favors the Bassini. Many of the operators who have reported cases demanding surgical relief for strangulation have followed no definite operative method. It is to be borne in mind when one operates in these cases, that the procedure is attempted primarily to save life, and not primarily to effect a radical cure. Occasionally complications present, making it advisable, even necessary, to do more than merely relieve the constriction.⁵⁶

Whitacre⁵⁵ discovered in a child of 7 weeks a strangulation which had been present 4 days. Upon making his incision, the gut was found to be not only gangrenous but wide open, freely discharging its contents. He resected 5 inches of the gut, and did a lateral anastomosis at the first operation, in addition to relieving the constriction. On the day after the operation he reopened the abdomen on account of persistent fecal vomiting and increasing tympanites. At this operation he placed an enterostomy tube just above the anastomosis. From this on the child improved, taking the breast 10 hours later. On the 6th day after the first operation he did a third operation, making an end-to-side (ileum into cæcum) anastomosis. The operations were apparently well endured, and the child made a good recovery. This serves as another brilliant illustration of infantile recuperative power.

The appendix, in several instances where present in the sac, has been removed during the operation for strangulation and with no ill results.

We are at liberty, therefore, to conclude, from the past experience of numerous able operators, that the operation looking toward the relief of strangulation in infants is not to be regarded as a very forbidding one. It should not consume a great amount of time, and if done promptly and with proper aseptic technique one should feel confident of a favorable outcome. Operation has undoubtedly been delayed, in the past, on account of the tender age of the patient, as well as of the fear of sepsis following. That this latter fear is largely unfounded is illustrated by Campbell's 305 cases in infants and children, 77 per cent. of them being under 3 years old and

34 per cent. under 6 months.¹¹ In his series of cases there were only two which suppurated.

Moreover, too many cases have been subjected to prolonged delay and treated to an excess of taxis. Such prolongation should be regarded as pernicious. No physician is justified in delaying operation until the prognosis is bad; and no operator need fear to handle these cases in the ordinary surgical way. The greatest mortality is due to procrastination, or unintentional or, perhaps, unavoidable delay before operation.

The treatment of the sac is somewhat important, inasmuch as the vas is very delicate in infants, usually lies close to the sac, and is very easily injured by manipulation. The risk of removing the sac, therefore, is emphasized by Lucas; and several operators feel that the sac is better left alone and neither tied, cut, nor removed.

The urgency of treatment is greater in these younger infants than in like cases occurring in adults, owing to the rapid necrotic changes which so commonly follow any interference with the circulation in the delicate bowel; the urgency is also greater, owing to the early appearance of shock.

The manner of suture, closure, and dressings has varied in the past and may be summed up in a few words: use the simplest method consistent with the severity of existing conditions. An attempt to transplant the cord is usually unnecessary. Simple suture of the soft parts and closure of the wound without drainage, and either the method of Stiles for superficial dressing, or sealing the wound with collodion, may be found preferable. Stiles recommended at first an emulsion of glycerine and iodoform; later he used dry boric powder. He bandaged the legs and arms and fixed the child so that the dressing could not be disturbed and left fairly free access of air to the wound. The urine in boys was collected by means of a glass tube left in place. Occasionally retention of the urine will be met with for the first day following operation.⁶¹

Some operators dislike the collodion dressing. It has its disadvantages. The writer's experience with the boric and

alcohol dressing, applied at every change of napkin, proved very satisfactory, and it is a reasonably simple procedure. Intelligence on the part of the nurse is essential to its successful use, one must add. There was no maceration of the skin, the chromic subcutaneous skin suture held the wound in close apposition, and there was absolutely no sign of infection at any time.

Some very successful cases have been reported where operation became imperative under most adverse circumstances—in the home, on a kitchen-table, no surgical assistance whatever and no reliable after-care.^{58, 44.}

The following table is presented of cases reported since 1907, and not included in Ashhurst's table of 15 cases:

Operator	Sex	Age	Duration of strangulation	Contents of sac	Condition of bowel	Result
Adams	M	2½ mos.	12-18 hours	?	Good Replaced	Recovery
Clogg	?	5 wks.	?	?	?	Recovery
Collins	M	18 days	12 hours	Small intestine	Good Replaced	Recovery
Cordier	M	2 mos.	?	?	Good Replaced	Recovery
Grossmann	?	4 wks.	?	Cæcum and appendix	Gangrenous	Recovery
Hopkins	M	4 mos.	30 hours	Intestine and omentum	Fairly good (adherent) Replaced	Recovery
Jopson	?	2 wks.	24 hours	?	Good Replaced	Recovery
Judd	M	22 days	24 hours	Small intestine	Good Replaced	Recovery
Ruotte	M	3 mos.	?	?	Good Replaced	Recovery
Ruotte	M	6 mos.	?	?	Good Replaced	Recovery
Sageron	M	18 days	24 hours	Cæcum and appendix	Fairly good Replaced App. removed	Recovery
Stern and Burnier	M	11 days	30 hours	Unrecognizable	Gangrenous Artificial anus	Recovery
Starr, V. H. . . .	M	5 mos.	About 5 hrs.	Small intestine	Good Replaced	Recovery

SUMMARY.

In proportion to the large number of herniæ existing in infants and children, the strangulated cases are comparatively rare, though case reports are becoming more numerous. It would seem that the older the infant the less subject to strangulation is he. In other words, hernia strangulation under one year is more common than later. Statistics show the greatest frequency in the first three months of life. The relative frequency of strangulation in children to that in adults is variously estimated as 1:62, 1:107 and 1:108. There seems to be a tendency to underestimate rather than to overestimate the number of cases calling for operation.

Writers are not agreed as to the specific cause of strangulation.

Few cases are reported wherein is demonstrated incarceration. The relatively short duration of strangulation probably accounts for this.

The cardinal symptoms peculiar to infants are violent and uncontrollable screaming, recurrent vomiting (often fecal), drawn facies, tendency to both retention of urine and rapid collapse.

The small intestine is most frequently found in the hernial sac. The cæcum and appendix have been found in the sac in from 7 to 20 per cent. of cases. The omentum is rarely found in the sac.

In the diagnosis one must be on the lookout for the possibility of acute hydrocele; also acute inflamed ectopic testicle.

Authorities are agreed that the prognosis in these cases is good in proportion as the diagnosis is established early and the case operated promptly. Some of the worst cases of gangrene and perforation have recovered under proper surgical treatment. Fear of infection should not be considered a serious objection to operating, when done under proper conditions.

While infants show a tendency toward collapse when the hernia is in a state of strangulation, this resolves itself when

the strangulation is relieved, and they recover rapidly and quite satisfactorily.

The consensus of opinion is that the mortality should be much less than in similar cases with adults. Most of the fatalities are due to waiting. Dowd believes the mortality should be 10 per cent. or less when the operation occurs promptly. Others would cut this down still further—to 3 per cent. or even less than 1 per cent.

Taxis is dangerous, and rough handling courts disaster. Taxis is seldom rewarded by reduction of the hernial tumor where strangulation exists. With the failure of reduction by taxis, operation is imperative, or the child will most assuredly die, for gangrene is the ultimate result of unrelieved strangulation.

In the majority of reported cases chloroform was the anæsthetic. Ether will probably be found preferable, in the light of the present-day attitude.

The Bassini operation in infants and children is favored by Cumston and others. For strangulation the simplest operation is the best, bearing in mind that the operation is done primarily to save life and not primarily to effect a radical cure. The occasional case will be the exception. The operation, from this view-point, should not be regarded as a forbidding one. From the number of successful cases reported, the tender age of the patient is no contra-indication. On the other hand, procrastination and continued insult by taxis are unjustifiable and tend to increase mortality.

The urgency of treatment is greater in infants than in like cases occurring in adults, owing to the rapidity of necrotic changes following embarrassed circulation; also greater, owing to the early appearance of shock.

Care should be rigorously exercised lest in treatment of the sac the delicate vas be injured by manipulation. The risk of removing the sac is therefore emphasized.

The manner of suture, closure, dressings, and other after-care will depend upon the operator and his preferences. The experience of the past yields no didactic rule.

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HERNIA ADIPOSA.

FAT HERNIA, FETTBRUCH, HERNIE GRAISSEUSE.

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INFREQUENTLY found in hernia regions, a condition termed fat hernia has been described as early as 1700 by Littre; case reports followed by Pelletain (1780), Cloquet (1819), Rosen (1850), English (1886), and Douglass (1889). Interesting and extensive theses by Wernher, 1869 (*Arch. f. path. Anat. Bul.*, xivii, 472), also by Jonathan Hutchinson (*Trans. of the Pathological Soc. of London*, vol. xxxvii), have been written, while during the past 20 years, either because it is not of sufficient surgical interest or because of its infrequency, practically nothing has appeared in medical literature about it.

ILLUSTRATIVE CASES.

CASE I.—*Incarcerated fat hernia, simulating irreducible inflamed omental hernia.*

History (Referred by Dr. M. Kleinman).—Wm. R., male, age fifty-three, for 15 years has had a reducible mass in the left inguinal region; always had worn a truss. Three months previous to my seeing him mass became irreducible, not painful up to about a week ago.

Examination showed a moderately tender mass about the size of a large orange in left inguinal region, extending well down into the scrotum, evidently coming out through the external ring. It was not fluctuating and not reducible; skin not adherent, dull on percussion, impulse on coughing, painful on pressure. Pulse normal, temperature 100°. Bowels regular. No vomiting. Diagnosis, irreducible inflamed omental hernia.

Operation (July 9, 1910).—Started with local anæsthesia and was able to proceed with this method up to and including the splitting of external oblique fascia. Dense adhesion of mass to surrounding tissues necessitated administration of a general anæsthetic, which was ether.

Upon splitting the external oblique fascia, a fusiform mass

FIG. 1



Incarcerated fat hernia, left inguinal canal.

of lobulated fat presented itself, extending from well below the external ring up to the internal ring, covered by thin fascial membrane at its lower part (intercolumnar fascia), also with a few spreading fibres of the cremasteric muscle. No sac was present. Densely adherent to surrounding structures particularly at external ring, as well as to the cord which was under the fatty mass. The external oblique fascia as well as the internal oblique muscle and transversalis were thin and well stretched. The mass occupied the entire length of the inguinal canal, tapering toward the internal ring, and originated in the preperitoneal fat at the site of the internal ring. After shelling it out the usual Ferguson operation was done.

On the second day patient began to pass bloody urine, very scant, and died of total suppression on the fifth day.

CASE II.—*Lipoma of inguinal canal with true hernial sac present.*

F. R., age twenty-five, referred by Dr. N. M. Mandl. Has had a double indirect hernia for past six or seven years. Always wore truss. Right side. Indirect scrotal hernia, left side, large ring present, but no hernial protrusion at time of examination.

Operation (October 11, 1909).—Right side: large sac containing omentum and adhering to sac. Resected. Usual Ferguson operation. Left side: sac present but closed at site where natural depression in the peritoneum at the internal ring was. To the fundus of this sac a pyriform shaped piece of fat, filling inguinal canal, size of a hen's egg was attached, undoubtedly causing a weakened canal, and large external ring. Both resected and operation completed as on right side.

Originating in the preperitoneal fat, it is not uncommon to find small elongated or pyriform shaped pieces of fat occupying the inguinal or femoral canals.

Unless it grows to an unusual size this condition does not give rise to any symptoms, and usually is not recognized before operation for hernia. When, however, hypertrophy of the fatty mass or lipoma occurs and during its growth becomes large enough to become appreciable, or appears at the external ring, or passes through the femoral canal and assumes or simulates the characteristics and symptoms of hernia, it is known as fat hernia.

Three distinct conditions may be present: (a) fat hernia

without true hernia sac; (b) fat hernia with sac accompanying it; (c) lipoma of canal not giving rise to symptoms.

As an independent condition, that is without a true hernial sac accompanying it, fat hernia is comparatively uncommon. There are more often present both fatty mass (extraperitoneal) and hernial sac, with or without contents. But this is not true fat hernia and should not be termed as such.

A pure fat hernia is extraperitoneal in origin and is not accompanied by peritoneal sac.

"In the sense of a true fatty tumor that forms in the subperitoneal fat, and from its own size and weight forces itself down through the inguinal canals, it is not believed that lipoma is very common" (De Garmo¹¹).

Fat hernia may be found in the inguinal or femoral canals, at the linea alba, between the umbilicus and ensiform cartilage, very rarely below the umbilicus; at the latter situation the lipoma protrusion, also with or without peritoneal sac accompanying it. In the female it is more often present in the femoral than the inguinal region, while the reverse is the case in the male.

J. Hutchinson¹² found them more often to be present on the left than on the right side. Some observers believe these fat masses to be a strong etiological factor in the causation of hernia whenever they are present in either the inguinal or crural canals, and it is only reasonable to suppose that whenever these lipomata originate in the preperitoneal fat as they almost always do, in their gradual growth they are bound to sooner or later stretch and thereby weaken the muscular and fascial investment of the canal, so predisposing to hernia. So that when either due to its size and weight or plus intra-abdominal pressure it descends through the canal, it may drag a process of peritoneum with it, so causing a true hernial sac.

"It has been recognized that a sac of peritoneum may be drawn out from the cavity of the abdomen and not extruded from it.

"This condition has been observed by many anatomists and surgeons, and its general features are doubtless familiar

to all. The process begins in a localized increase of sub-peritoneal fat, usually observed in relation to the abdominal openings of the inguinal and crural canals, seeing that at these parts a depression naturally exists, into which the fat may develop. The interest of the process as occurring in relation to the deep abdominal ring is very great. The walls of the inguinal canal lie in close apposition, a relation which intra-abdominal pressure tends to maintain. If, however, a mass of fat is formed in the subperitoneal tissue of the external inguinal fossa, as it increases it will insinuate itself in front of the defined inner pillar of the deep abdominal ring, and separate it from the anterior wall of the inguinal canal. The process thus begun goes on until the canal is wholly occupied by the fatty protrusion, which ultimately projects at the superficial ring. I have observed the fat in the tissue of the cord, and also in other instances quite separate therefrom and lying about it. As the protrusion of fat increases in size and weight, it renders the canal still more patent, and by its weight and also by adhesions formed with the superficial tissues the peritoneum is drawn down after it." ¹³

In the region of the linea alba, either because of diastasis of the fascia or due to some unusual strain, these fat masses slip through the fascial opening, so giving rise to true fat hernia.

Another writer believes that the formation of the pad of fat in the canal is the cause of spontaneous healing of hernia.

De Garmo is probably right when he states that: "If there is nothing but fat in the canal, the wearing of a truss for a year may destroy it, and it is in such cases that occasionally we have records of remarkable cures of hernia in the adult by truss wearing." ¹¹

These fat masses vary in size and shape, usually originate from the preperitoneal fat, are lobulated, and held together by a fine network of thin membrane, which sometimes has the appearance of peritoneal sac or covering and may be mistaken for the true sac if this be present.

In its gradual growth it attaches itself to the cord and walls of the canal; may be attached to the fundus of the sac, to the cord alone, or it may envelop entirely the hernial sac.

"The capsule in some cases very closely resembles peri-

toneum, the chief difference being that it usually gives off many septa which lie between the contained lobules of fat. Sometimes, however, the capsule is so thin that it can hardly be detached.

"The contained fat differs only from omentum in that it is usually in large lobules unconnected together by a distinct membrane" (Jonathan Hutchinson¹²).

Through exploration of the fat mass when present is of practical importance and value in operations for hernia, because a small hernia sac may be covered over by it and overlooked.

The fat mass in the inguinal canal may be that of pre-vesical fat; the bladder or hernia of this viscus is to be thought of therefore so as not to cause injury to this organ.

Like a hernia, these lipomata in herniating through the external ring or septum crurale or linea alba may become either strangulated or irreducible.

The presence of a small fat mass in the canal is unimportant so long as it remains so, and its presence is practically impossible to diagnose until it gives rise to symptoms by either having passed through the external ring, through a split in the fascia as sometimes happens, or whenever it becomes strangulated. Pain, then, is a natural consequence and is present when circulation is interfered with.

When they grow to large size and assume the characteristics of a hernia the diagnosis is also difficult, especially so its differentiation from omental hernia.

In reducible fat hernias the characteristic "doughy feel" which a lipoma gives and that it is not *entirely* reducible, that is not within and into the abdominal cavity as an ordinary hernia would be, may give us a clue as to the true nature of the condition present.

There is no way whereby we can differentiate an irreducible fat hernia from that of irreducible omental hernia. Impulse on coughing may or may not be present in either case.

De Garmo¹¹ says: "It will be found, however, that when a swelling of this character is reduced to the canal it can still be felt under its fascial coverings. It does not drop back suddenly as would a piece of true omentum."

The differentiation of fat hernia occurring at the linea alba from that of ventral omental hernia meets with the same difficulties.

When hernia is complicated with lipoma, thorough removal of all fat masses is necessary, as their presence tends to prevent proper closure of the canal by sutures. When these grow to large size and are recognized as such, they should be removed because they undoubtedly tend to weaken the canal and so predispose to the formation of true hernia.

SUMMARY.—1. Comparatively uncommon as an independent condition, that is without true hernia sac accompanying it.

2. It originates in the and is a hypertrophy of the preperitoneal fat.

3. When present, it may cause true hernia by drawing down a process of peritoneum in its growth and descent.

4. It is difficult to differentiate it from omental hernia when irreducible.

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FORMATION OF AN ARTIFICIAL VAGINA BY INTESTINAL TRANSPLANTATION.*

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ABSENCE of the vagina may be congenital or acquired, if one can define a loss as an acquisition. In the former the internal organs of generation generally share in the aplasia, but not infrequently the ovaries are present and functionally active. In obliteration of the vagina consequent upon cicatricial contraction the result of traumatism, operations, cauterization, or the severer forms of vaginitis, the uterine cavity and the ovaries likewise may have been destroyed or the uterus and the ovaries may have been removed, but in many instances they remain unaffected physically and physiologically. The functions of the vagina are to drain the menstrual fluid, to serve as an organ of copulation, and to act as a birth canal. If the vagina is absent and the internal organs of generation are healthy, there is no question as to the necessity for the creation or the restoration of the vagina, first and above all to permit the retained menstrual fluid to escape, and second, if the patient is married or contemplates marriage, to allow sexual intercourse. It is doubtful whether any artificial vagina would serve as a birth canal. Of course, one could, instead of building a vagina, suppress the menstrual function by removing the uterus or the ovaries or both the uterus and the ovaries, but all would agree that these organs should be preserved unless their condition demands their removal. If the internal organs of generation are absent or functionally inert, should a vagina be formed merely for the purpose of sexual intercourse? This is the question with which we were confronted in the case herewith reported.

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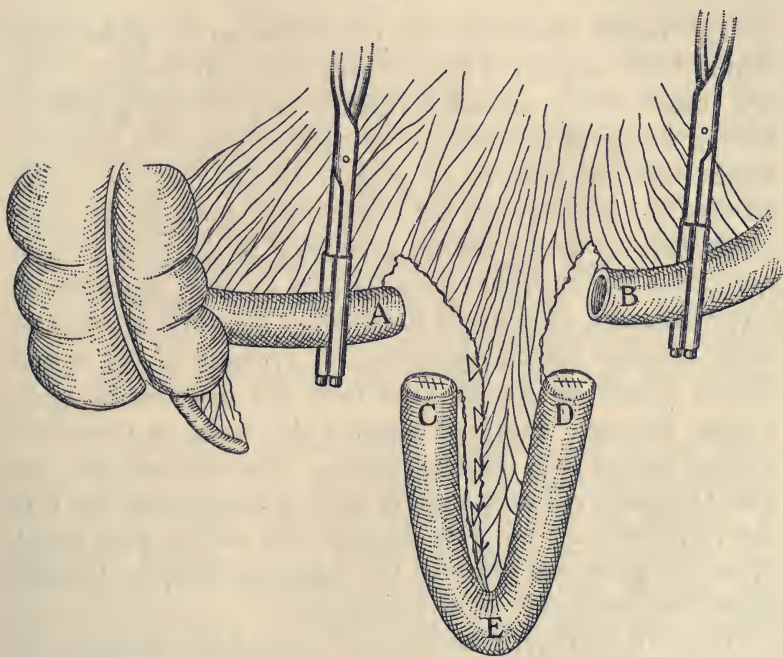
The patient, a woman aged forty-three, entered the Pennsylvania Hospital August 30, 1911. Seven years before admission a panhysterectomy had been performed in a neighboring hospital for carcinoma of the uterus. The bladder was accidentally torn or cut during this operation, and several attempts were made subsequently to close the resulting vesicovaginal fistula, all, however, without success. Upon examination the vagina was found to measure about two inches in depth and two inches in width. At its upper end was an opening, the size of a quarter of a dollar, leading into the bladder, which was markedly contracted and somewhat inflamed. After several superficial ulcerations which were present in the vagina had been induced to heal, we attempted to close the fistula in the following manner: The entire vaginal mucous membrane was excised, except over an area on the posterior wall corresponding in size to the opening in the bladder. The posterior vaginal wall was then separated from the rectum, and sutured to the anterior vaginal wall with catgut sutures, the undenuded area being fitted to the opening in the bladder. The perineum had been split to facilitate these manoeuvres, and the split, together with the space existing between the rectum and the new floor of the bladder, was now closed with buried catgut sutures, and a few sutures of silkworm-gut emerging on the skin of the perineum, thus obliterating the vagina. In separating the posterior vaginal wall from the rectum, scissors had to be used freely because of the large amount of scar tissue resulting from a previous perineorrhaphy, and during one of the snips the rectum was unexpectedly wounded. The small opening in the rectum was immediately sutured and gave no further trouble. The bladder was drained for 10 days by means of a retention catheter passing through the urethra. At the end of two weeks, there having been no leakage in the meantime, an assistant, without orders, irrigated the bladder because of the turbidity of the urine. Following this a small urinary fistula, finding exit on the perineum, was discovered. During the day the patient passed most of the urine through the urethra, but at night there was a constant dribble. The patient left the hospital, and returned at the end of three months asking that the vagina be reopened. She was content to endure the leakage of urine, but

stated that she must have a vagina or her husband would desert her. At first we demurred, but her pleadings were so earnest that we consented on the condition that the other members of the Surgical Staff agree with her as to the necessity for the building of a new vagina. Drs. Harte, Hutchinson, Gibbon, and LeConte, of the Hospital Staff, and Dr. Binney, of Kansas City, who was visiting the hospital at that time, examined the patient, and all unhesitatingly took sides with her, one of the gentlemen stating that any operation destined to preserve the marital relations and keep the home intact was not only justifiable but mandatory. We selected intestinal transplantation as the method most likely to give an enduring success. The nature and the possible dangers of the operation were explained to the patient, but she was not to be frightened. Loss of life meant less to her than the loss of her husband.

Accordingly the operation was performed, November 16, 1911, before the Congress of Surgeons of North America, which met at that time in Philadelphia. The patient was placed in the lithotomy position, an incision made between the labia, and a space created between the bladder and the rectum by blunt dissection, which space was cautiously deepened until the peritoneum had been opened. A temporary tampon was then inserted, the patient placed in a horizontal position, and the abdomen opened by a longitudinal incision above the pubes. Our idea was to use, instead of the small intestine, the sigmoid flexure, because of its larger size and the absence of digestive juices, but finding its mesentery too short we were forced to select a segment of the ileum. A coil not far from the cæcum was drawn from the abdomen and found to reach well down over the pubes without tension. Both limbs of this coil, which measured about ten inches, were ligated and severed from the remaining small intestine, upon which clamps had been placed, and the ligated ends invaginated with silk sutures, the free ends of the ileum being united end to end by simple sutures. The mesentery attached to the distal (cæcal) half of the isolated loop of intestine was now ligated and divided, so that there should be no tearing of the mesentery when the loop was drawn down to the vulva, and so that the site of anastomosis would not be dragged down into the pelvis and thus predispose to kinking

(Fig. 1). Long forceps were now passed up through the space between the bladder and the rectum by an assistant, and the piece of intestine which had been severed from its mesentery drawn out through the vulva. The vesical peritoneum was next sutured to that of the sigmoid around the transplanted intestine, and the wound in the anterior abdominal wall closed. The patient was again placed in the lithotomy position, that part of

FIG. 1.



Segment of ileum (C E D) isolated, the ends C and D ligated and invaginated, and the mesentery along the distal half (from C to E) tied and cut. The end C was drawn out through the space between the bladder and rectum, the bowel at E attached to the vulvar orifice, and the excess (from E to C) cut off. The ends A and B were united by end-to-end anastomosis.

the ileum lying against the opening in the bladder fixed in position with catgut sutures, thus closing the fistula, the intestine protruding from the vulva (*i.e.*, that portion which had been severed from its mesentery) cut off, and the open end of the intestine sutured to the vulvar orifice. The new vagina was filled with gauze, so as to press its walls against the walls of the space between the bladder and the rectum.

The convalescence of the patient was uneventful, except that after a few days urine began to trickle from a small opening just below the urethral orifice. One year later the vagina admitted the index and the middle fingers for their entire length, and was performing the function for which it had been designed. Although there was still some leakage of urine the patient expressed herself as satisfied with the result, and refused further interference for the repair of the fistula.

The earlier operations for the formation of an artificial vagina were among the most unsatisfactory in surgery. The new canal would almost invariably become obliterated or useless, owing to cicatricial contraction, despite the energetic employment of dilators or plugs. Lining the raw cavity between the bladder and the rectum with epithelial or endothelial flaps or grafts seemed promising at the time of their application, but the ultimate results were failures. Mackenrodt, in two instances, successfully transplanted flaps of mucous membrane obtained during operations for prolapse of the uterus. Others turned in dermal flaps from the neighboring parts (Abbe, Burrage, Beck) or papered the walls of the newly formed vagina with Thiersch grafts. Stoeckel and Von Ott split Douglas's cul-de-sac, drew flaps of peritoneum down to the vulva, where they were sutured, and packed with gauze. When the gauze was removed the vagina contracted. Dreyfus ingeniously made use of a hernial sac.

Gersuny, in 1897, was the first to utilize the rectum, or at least a part of it. He fashioned a pedunculated flap, attached above, from the anterior wall of the rectum, sutured this flap beneath the bladder, and then closed the wound in the rectum. The sphincter ani was cut, so that there would be no constipation and interference with healing. The anterior vaginal wall was thus covered with epithelium, which, it was hoped, would finally extend over the entire raw surface. Two cases were treated in this manner. One had, at the end of ten months, a vagina completely lined with epithelium which admitted the index finger; the result in the second case is not known.

In a third case of the same kind small grafts of epithelium were placed also on the posterior wall of the new vagina. A rectal fistula followed but finally healed, and at the end of five and a half months the vagina measured 9 cm. long and 7 cm. in circumference. Pupel operated in a similar way, with a rectal fistula and narrowing of the vagina as a result. Amann modified the Gersuny operation by forming the rectal flap into a tube, a procedure requiring an unusually large rectal ampulla. Shubert cut the rectum at each extremity, closed the upper end, displaced the rectum forward, and sutured the sigmoid to the sphincter ani. Four months later the result was satisfactory, except for a tendency to narrowing at the vulvar orifice. Albrecht did the same sort of an operation, except that he used the sigmoid instead of the rectum. Sneguireff resected the coccyx, severed the rectum at its upper part, sutured the lower end of the upper segment of bowel into the wound, thus establishing an artificial anus, and closed upper end of the rectum, which was then used as the vagina. Most writers heap reproaches on this operation, for obvious reasons.

All continental writers, with the exception of De Bovis, give Häberlin (1907) the credit for suggesting transplantation of the small intestine for the purpose of forming an artificial vagina. As a matter of fact, the operation was devised by J. F. Baldwin, of Columbus, Ohio, in 1904, and first performed by him three years later. Since this time he has operated upon three additional cases, using the small intestine in each instance. Baldwin's method consists in opening the abdomen and drawing a coil of ileum down to the vulva by means of forceps, introduced through the space previously created between the bladder and the rectum. The upper ends of the coil are then severed and each end closed by an inversion suture, the continuity of the remaining bowel being restored by end-to-end anastomosis. The abdomen is then closed, the patient placed in the lithotomy position, the loop of bowel, still held with the forceps, opened and sutured to the skin, and each limb of the loop packed with gauze.

Thus there are two vaginas, the septum between which is removed in ten days or two weeks by clamp pressure. In addition to the four cases reported by Baldwin the small intestine has been employed in six instances to form an artificial vagina, thus making ten in all. Stoeckel (1912) and Abadie (1912) each proceeded in substantially the same manner as Baldwin. Mori (1909), Mueller (1910), and Halban (1912) isolated a segment of ileum, closed the upper (oral) end, and dragged the other (cæcal) end down to the vulva, re-establishing, of course, the intestinal canal by anastomosis. It is difficult to understand how, without dangerous cutting or tearing of the mesentery, this dragging down of one end of the isolated segment could be accomplished, unless the site of anastomosis also was dragged down into the pelvis and kinked. In order to avoid this traction on the site of anastomosis, without compromising the nutrition of the bowel, and desiring to construct a single vagina, instead of a double vagina as in the Baldwin operation, we removed a portion of the bowel, as described above. If the uterus had been present we should have sutured the upper end of the transplanted bowel around the cervix.

Of the ten patients thus far operated upon all recovered and secured an excellent result. Stoeckel found that in his case the mucous membrane of the transplant continued to elaborate intestinal juices, and that the amount varied with the character of the food taken into the stomach; thus on an albuminous diet the total quantity of secretions in 24 hours was 6.2 c.c., on carbohydrates 3.7 c.c., and on fats 2.1 c.c. Stoeckel calls attention also to the increased danger of absorption and poisoning if corrosive sublimate, carbolic acid, lysol, or other strong antiseptic is employed as a vaginal douche.

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THE REDUCTION OF OLD UNREDUCED DISLOCATIONS OF THE SHOULDER.*

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THE best treatment for the old unreduced dislocations of the shoulder is still undecided, although there is probably no question concerning traumatic conditions of the shoulder that has been the subject of more prolonged and earnest discussion. The most definite result that has been attained is the general tendency toward earlier operative interference, the chief advantage of which is that the severe force necessary for the reduction can be applied with less danger of fracture of the humerus and with greater safety to the surrounding important vessels and nerves. But the results of such operations are far from satisfactory, in many cases the reduction still remaining impossible and the operation frequently ending in an excision of the head of the humerus. That nearly all dislocations become practically irreducible after three months, and that they often become very difficult of reduction in as many weeks, is generally conceded. As a medical student I was taught that attempts at reduction should be made up to three months, and that even after that, operation was not of necessity indicated. There was a considerable difference in the views of teachers then as now. Although Kocher¹ operated as early as five and seven weeks in some cases, his record of non-operative reductions has probably never been equalled. He reported 25 successful reductions out of 28 cases, after 5 months and 22 days in the longest and 5 weeks in the shortest. The position taken by Lund² 15 years ago probably represents the present general tendency among surgeons as

* Read before the Academy of Surgery, Philadelphia, October 7, 1912.

well as any. According to Lund, "after more than six weeks have elapsed, such changes have usually taken place as to render success, with such manipulative methods as it is safe to employ without danger of fracture of the humerus or rupture of the axillary artery, improbable. If reduction is to be accomplished at all, it is to be accomplished by arthrotomy, with or without resection of the head of the humerus." He refers to the "remarkable case of Burrell" in which the reduction was accomplished without operation after eight months. Cavaillon,³ in his report of a case reduced after six months by Jaboulay, says that Koenig reduced one after eight years and Sedillot one after one year without operation. The opinion of the profession generally, at the present time, is probably expressed in the statement of Forque and Reclus, quoted by Cavaillon, to the effect that success by manipulative methods in such old cases made them pernicious examples, evidently, because they encouraged too daring and dangerous attempts by others. The axillary vessels have been ruptured in rare instances and the humerus fractured many times. Kocher fractured the humerus in the three cases in which he failed to reduce the dislocation, and likewise in one of his operated cases in the efforts to reduce by his method before operation, resecting the fractured head in the operation. In another of the operated cases the upper end of the humerus was fractured in attempts at reduction before the patient came to the hospital.

It would be generally admitted that the average functional result following a non-operative reduction is better than that following an operative reduction. Jonas,⁴ in supporting the operative method, says: "The division of muscles, especially the deltoid and the subscapularis, has often been extensive and the separation of fibrous and capsular structures extended over a wide area, before reposition became possible." I doubt if as much damage is done to normal structures in the usual reduction by manipulation, so that the return of function should be more rapid and more complete. It is very likely, however, that complete return of motion and function is rare even after the non-operative reduction, except perhaps in cases

of two or three weeks' duration. The increased tendency toward operative reduction is to be explained by the almost insurmountable obstacles to reduction in many cases, and the present-day well-developed technic for operations in general. Yet, notwithstanding the very large number of operations which have been done by the best surgeons, we have no reason to be particularly proud, even when the reduction has been accomplished. The mortality of operation has been considerable, while the non-operative reductions have a much better record in this respect. Kocher, for instance, had one death from sepsis in his eight operative cases, but none in his 25 successful and three unsuccessful non-operative cases. In another operative case, a sinus was still present nearly seven years after operation.

One is apt to underestimate the difficulties until he has attempted the reduction in one of these cases. The humeral head is not far removed from its normal place in the socket. The anterior glenoid margin, in the subcoracoid variety, is in contact with the cartilaginous portion of the head, above and posteriorly, just anterior to the anatomical neck, so that the greater tuberosity is still in the glenoid cavity or directly over it, and only the rounded portion of the head is anterior to the glenoid margin. Yet to bring the whole of the head back into the socket, after a few weeks, is often very difficult. The particular obstacle to reduction has never been satisfactorily demonstrated.

During the last four or five years I have had considerable interest in the results of traumatic conditions about the shoulder, many of which are very obscure. I began early to pay attention to the old unreduced dislocations and to theorize, on the basis of the cadaver dislocations, as to the cause of the difficulties in reduction. The first fact to attract my attention was that the reduction, which is usually very easy under full anæsthesia at the time of the accident, becomes very difficult in two or three weeks, and that without regard to whether the X-ray shows a concomitant fracture or not. To my mind that meant that the obstruction was in the soft tissues. My first conclusion was that it was due to a short-

ening of the muscles and that it was somewhat of the same nature as that encountered in an old ununited fracture. In the meantime I had been trying to work out the solution of the problem of other conditions in this region, as the recurrent dislocations, stiff and painful shoulders, and some traumatic brachial paralyses. I ultimately concluded that these conditions were all the results of dislocations and their analogous but milder conditions, the sprains of the shoulder, and that the essential lesion in all was the laceration of the axillary portion of the capsule. I have satisfied myself that the capsule of the shoulder-joint is not the negligible structure that it is generally thought to be, and that the best treatment of these cases is that directed to the cicatricial changes which have occurred at the site of the capsule tear. I then concluded to study, so far as my limited opportunities would permit, the possibility or probability that the chief resistance to reduction in old unreduced dislocations came from the same cicatricial changes, which tend to fix the head in its dislocated position. These changes could advance far enough in two or three weeks to offer a considerable resistance to reduction, and the longer the dislocation remained the greater would be the contraction and resistance of the cicatricial tissue. I had not at that time, but have since studied Kocher's paper in which his conception as to the obstacles was based upon his previous cadaver observations and upon his experience with 36 cases, eight operative, and upon an autopsy on a case in which he had not attempted reduction. Although he had attached considerable importance to irregular bone formation and fragments, he says that his main contention, which he justified by his operative cases, was that the reduction was obstructed not by adhesions between the humeral head and scapula, but by the contraction in the region of the old capsule tear between the margins of the glenoid and the anatomical neck of the humerus. These closed the capsule tear, he says, and hindered the raising of the capsule from the glenoid so that the head could not enter. In other words the margins of the rent in the capsule, which he believed offered a considerable resistance to reduction in the recent

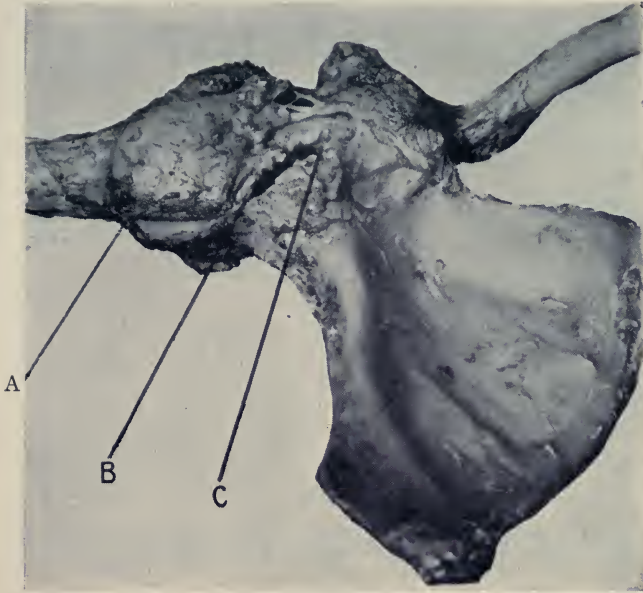
condition, now became thickened and contracted by cicatricial tissue and thus accounted for the increased difficulty. In his post-mortem dissection, however, he "found no capsule tear anywhere" but where it was originally, "a closed fibrous tissue covering passed over the head everywhere."

His conception of the rent in the capsule was obtained from his study of the dislocation on the cadaver.⁵ But in producing it he followed Malgaigne's method of first dividing the capsule by an incision in the axilla, from the lower border of the subscapularis to the origin of the triceps. As I understand it, he made a longitudinal incision from the glenoid to the humeral attachment, in the lowest part of the joint. He then produced the dislocation by raising the arm to the vertical position "with force" and pushed it outward. On dropping the arm he found that he had a complete subcoracoid dislocation. If the head escaped through the opening in the capsule which he made with the knife and which was longitudinal, the margins would probably close about the neck of the humerus and offer a considerable resistance to reduction. On the basis of observations made upon capsule specimens dissected after a dislocation had been made by forced abduction and upon intact capsule specimens, I concluded that such a result is impossible. I have since produced a dislocation on the cadaver after making such an incision in the capsule as Kocher describes and am still more convinced that the head cannot escape from the socket through such an opening (Fig. 1, AB). As the arm is carried into abduction, the axillary portion of the capsule becomes tense and limits the abduction (Fig. 2). The effect upon the longitudinal opening is to bring its margins together so that the dislocation cannot occur until the abducting force has made a more or less extensive new tear in the capsule at an angle with the longitudinal opening (Fig. 1, BC). The presence of the incised opening probably influences somewhat the direction and extent of the tearing, but before the dislocation could occur there would be a more or less transverse rent that, added to the incised opening, would present a very large opening into the joint, in the axillary or antero-inferior por-

tion (Fig. 3). Without such an incision, the tearing usually takes place from the glenoid or humeral attachment. Since the capsule conditions which Kocher emphasized in his description of the cadaver dislocation tallies almost if not exactly with what I have seen repeatedly in my cadaver work, I believe that his longitudinal incision had only little influence upon the size of the transverse rent which permitted or was caused by the dislocation. As I have seen the laceration of the capsule, its margins cannot become constricted about the neck of the humerus in a recent dislocation. It is too extensive and its transverse direction will not permit it (Fig. 4). This view is not original since Professor G. G. Davis taught his classes in applied anatomy at the University of Pennsylvania for more than ten years that the margins of the rent in the capsule would not prevent reduction of a recent dislocation.

On the other hand I find that the conclusions which I had reached concerning the cicatricial changes in the capsule and upon which I had based my efforts at reduction in my first four shoulders (three patients), did not differ greatly from those which Kocher had reached. The one difference which I regard as important, *i.e.*, as to the importance of the margins of the rent in resisting reduction by constriction about the neck, has led me to reject the Kocher method of reduction and to employ the old method of abduction, or one of the abduction methods, and because of the good results which I have obtained with it have concluded to report the results of my observations and to support the method which I think is best. While Kocher says that his main contention which concerned the cicatricial changes at the site of the tear in the capsule was based upon his operative cases, it is evident that his interpretation of the effect of these changes was based primarily upon the conditions found in the cadaver dislocations. He assumed, therefore, that the subcoracoid dislocation in the cadaver produced by forced abduction, since that is how he produced it, represents the same condition as the subcoracoid dislocation in life. The work which I have already done on traumatic conditions of the shoulder is based upon the same assumption, with the further conclusion that

FIG. 1.



Capsule preparation from cadaver dislocation produced by Malgaigne method which was employed by Kocher. View from below and anteriorly. *A*, *B*, opening made in lower part of capsule by incision; *B*, *C*, increase in capsule opening made in producing dislocation by abduction after incision was made. At *B* the capsule margins were approximated by a suture, to indicate the junction of the incised and tear portions of the capsule opening necessary for the occurrence of the dislocation.

FIG. 2.



Limit of abduction with scapula fixed in normal position (when arm is hanging at side). Axillary portion of capsule tense and humeral head held firmly against glenoid surface. Further abduction will tear axillary portion of capsule.

FIG. 3.



Same preparation as in Fig. 1, showing size of capsule opening produced by the combination of incision and tearing, and necessary for the occurrence of the dislocation.

FIG. 4.



Capsule specimen of subcoracoid dislocation produced by forced abduction without incision. Upper margin of capsule tear carried forward with head under coracoid process. Humeral head has not passed through the rent, the margins of which do not constrict the neck. Therefore, in a recent dislocation they will not obstruct the reduction. The gap in which a portion of the head presents will later be filled in by cicatricial tissue, which, in an old dislocation, will offer the chief obstacle to reduction.

all anterior dislocations are essentially the same. The cadaver dislocation, therefore, makes an excellent basis upon which to build up the probable results in life of the later cicatricial changes. In this way I determined to my own satisfaction the pathology of the recurrent dislocation, and upon this basis have now operated on 12 cases and have assisted in another, with only one recurrence of the dislocations. I believe that there is very little difference between the capsule conditions developing in the recurrent and the old unreduced, except that in the latter the continuance of the dislocated position has permitted the capsule about the humeral head to become firmly fixed in its abnormal position. In both conditions the capsule is completely repaired, but to meet abnormal conditions, *i.e.*, to permit the humeral head to occupy the dislocated position. Kocher "found no capsule tear anywhere" in his autopsy but "a closed fibrous tissue covering passed over the head everywhere." No one has yet reported that he found the tear unhealed in an operation on a recurrent dislocation.

In my effort to locate the obstructing portion of the changed capsule, I have taken for the type, as did Kocher, the dislocation without fracture, in which the upper and posterior portion of the capsule was not torn. With the head in the abnormal position, the lacerated capsule would, of necessity, adapt itself to the altered relations of the articulating surfaces and this rearrangement can be observed on the cadaver (Fig. 4). When the tear is from the glenoid margin, which is probably the most common variety, the torn portion of capsule attached to the humerus maintains about its normal relation to the head as does the capsule to the neck and head of the femur in the corresponding condition in the hip (as shown by Allis⁶). The head of the humerus protruding at the site of the rent, but not completely through it, separates the upper torn edge of capsule from its normal place at the glenoid margin, so that later when the gap has been filled in by new cicatricial capsule this portion of the repaired capsule is longer than normal by the width of the gap. Therefore, the obstruction cannot come from this portion of the repaired capsule. The posterior portion, which is dragged

tensely over the glenoid cavity by the head in its dislocated position, will be kept continuously at its normal length so that, because of its length and the fact that it is not put under tension in the reduction, it will not resist the return of the head to the socket, unless it becomes adherent to the glenoid surface as Kocher found in one of his operated cases. Even if it does, the traction on the humerus in abduction might separate it during the reduction. But in the regions between these two portions the capsule conditions are not so favorable to reduction. The undamaged portions at the upper and lower limits of the rent pass forward and inward with the head, so that instead of having a vertical direction as in the normal condition they now are about transverse, and as Kocher showed for the upper portion are rolled somewhat into a cord (Fig. 5). Cicatricial tissue fixes them to the corresponding portions of the scapula, the upper portion near the base of the coracoid process and the lower portion near the bottom of the glenoid cavity. I believe that these two portions of the capsule must be torn more or less before the head can be brought back to the socket, and that it will require considerable force to tear them.

I had determined that traction on the humerus at about a right angle with the trunk, firm fixation of the scapula, and traction or direct pressure on the head toward the socket was the safest and best method of breaking this resistance, but was still concerned about the risk to the axillary vessels and nerves. I knew that severe force had been applied by a variety of methods in a large number of cases, and that vessel rupture, at least, was very rare. A study of the normal relations and those of the dislocation on the cadaver gave some interesting results in connection with this phase of the subject. Normally, the capsule is practically completely covered by the short rotators. With the exception of the circumflex, none of the large vessels and nerves lies directly in contact with the capsule, the circumflex nerve and posterior circumflex vessels being in contact with a small portion of it near its humeral attachment. In an anterior dislocation, the humeral head passes downward and forward, and overlaps

for a short distance the glenoid margin but still remains under the subscapularis, which continues to separate it from the large vessels and nerves. These are adherent to the upper surface of the muscle, and do not move with the head when it is being luxated, so that they come to occupy a position anterior to the dislocated head, and in my opinion are not in danger from direct pressure on the head toward the socket, if that pressure is made over the most prominent portion of the head and from a position somewhat posterior. Kocher emphasized the danger to these structures from the heel in the axilla in the Cooper method, which seems to have been the most popular one in recent dislocations up to that time, and it is this danger which was probably the most important factor in obtaining for the Kocher method the rapid and extensive recognition which it received. While they should always be respected, I believe that the danger to the vessels and nerves has been over-rated, especially when the arm is in abduction. I have now operated on two cases of recurrent dislocation of the shoulder through an axillary incision behind the large vessels and nerves, reaching the capsule in the space between the lower border of the subscapularis and the adjacent border of the latissimus dorsi. With a little traction upward on the subscapularis I came directly upon the most prominent portion of the head. This was maintained in the dislocated position to bring it nearer to the surface. The large vessels and nerves did not come into view at any time: The circumflex nerve and vessels were below the most prominent portion of the head in both cases, but in one the subscapular branches of the axillary vessels lay almost directly over the prominence. Although much direct pressure was made on the head in the reduction, in all my cases, in some of them very severe, not one complained of any disturbance that would indicate any damage to vessels or nerves. If the subscapular vessels came in the line of pressure, either they could tolerate very much pressure without suffering or they moved away as the pressure increased, as could easily happen, since the comparatively thick subscapularis muscle intervenes between the vessels and the humeral head. In view of these

observations, the large number of reductions and attempts at reduction in old dislocations with severe force and the infrequency of nerve or vessel rupture, I believe that usually dangerous involvement of the nerves and vessels in the cicatricial tissues does not occur. Guibe⁷ studied the lesions of the axillary vessels complicating dislocations of the shoulder, with special reference to the treatment of these complications. He says that it is difficult to determine their relative frequency, that they are very rare but not exceptional. Hennequin did not mention them in his treatise on dislocations, which shows, Guibe thinks, that he had no personal experience with them, although he probably saw and reduced more dislocations of the shoulder than any other man in France, at least old dislocations. Of the 78 cases collected from the literature by Guibe, it appears that in only 31 were the axillary vessels ruptured during attempts at reduction of old dislocations, and most of these were of six weeks' duration or less. In the remaining cases the complication occurred at the time of the dislocation or of the reduction immediately afterward. With the abduction method which I have employed there should be the least danger, because by it the head is dragged back to the socket by the shortest and most direct route. Kocher in describing the findings in his autopsy case said that the nerve cords and vessels were somewhat removed from the head. I searched several museum collections for a wet specimen of an old dislocation but failed to find one.

To formulate a theory is one thing, to apply it in the presence of danger is quite another. I was prepared, however, to test it when the opportunity came. I wish to acknowledge here that I was further prepared by a statement made by Professor Edward Martin, based upon his operative experience, to the effect that in his opinion the chief obstacle to reduction was ligamentous. This was the main point in my observations. Soon afterward I again took advantage of his rich experience. In one case after the usual efforts to reduce by non-operative methods, he exposed the joint, and after dividing such obstructing tissues as could be located and after failing to bring the head into the socket by the Kocher

and other methods, under protection of the field of operation, he placed one foot against the axillary border of the scapula and pulled strongly outward on the arm in abduction, with immediate reduction of the dislocation. While the head had been considerably mobilized by the operation, to my mind, it was of much importance that the abduction method succeeded after the Kocher and other methods had failed. I valued this encouragement the more when I found that in my first case the dislocation had existed for eight months, and that an unsuccessful effort at reduction under ether had been made at the end of three months. I succeeded in the reduction only after the use of much force, but the after-course was quite uneventful.

I realize that the superiority of the Kocher method over all others in old as well as recent dislocations has become so firmly established that it will not be an easy matter to obtain consideration for any other. The abduction method, however, is an older one and has done good service in the past. Kocher's success with his method seems to have been greater than any one else has had with it in old dislocations, probably because in addition to knowing it better than any one else he risked more force than most surgeons would employ. His only failures were in those cases in which he could not employ more force by his method after fracturing the humerus. Such success as I have had with the abduction method is to be explained by the fact that I could use enough force to reduce the dislocation in every case without fracturing the humerus. The one failure was not due to inability to reduce but to keep it reduced. It is my belief that it is distinctly superior to the Kocher method in old dislocations, and I have hoped that I could show that it was. In this connection the suggestion of Dr. A. C. Wood is most valuable. He said that the principle of the abduction method was exactly the same as that which Allis⁶ established for dislocations of the hip. By reversing the steps of the mechanism of the dislocation, Allis merely drags the femoral head back to the acetabulum through the same path by which it reached its dislocated position. Some years ago Dr. Allis

gave me the following brief and simple illustration of the principle of his method: "If a boy after diving into the water were to come back feet first, he would be doing what I try to do in dislocations of the hip." Kocher considered that the effectiveness of his method depended upon the same principle as that of the Bigelow or circumduction method, and that the coracohumeral ligament of the shoulder is analogous to the Y ligament of the hip.

In the Bigelow method the Y ligament is depended upon to stand the chief strain in bringing the head back into the socket. This is accomplished by a series of movements calculated by twisting to shorten it and by using it as a fulcrum to pry the head into place. While the coracohumeral ligament may be the analogue of the Y ligament, as Kocher suggests, it is not nearly as strong as the latter, actually or relatively. Its upper single limb arises from the outer edge of the horizontal portion of the coracoid process, and soon fusing with the capsule runs without very distinct borders to both tuberosities, crossing the bicipital groove (Piersol). Kocher in his first paper, in which he introduced his method and in which he referred only to recent dislocations, stated that the rotating mechanism was destroyed and the method was rendered ineffective when the greater tuberosity was broken off or almost the whole capsule torn away. I have found the latter condition several times in my cadaver work. He found the greater tuberosity broken off in seven of his eight operative cases. He had no means of determining the frequency of this condition in his non-operative cases, except by the finding of crepitus which is a very uncertain sign. The X-ray has shown that this fracture is much more frequent than was formerly thought. In the presence of this fracture, I think, that the conditions are made relatively more unfavorable for reduction in old dislocations. Reunion may have taken place but in such a case it is likely to be faulty. But even if the coracohumeral ligament which is attached to the greater tuberosity remains intact, it becomes involved in the cicatricial tissue, because it is at the upper limit of the rent and is carried forward and upward to the site of the greatest cicatricial

shortening of the repaired capsule. It would be difficult to calculate what its influence is under such circumstances, but it is fair to assume that it cannot be as effective in old as in recent dislocations. In reduction by the Allis principle, the capsule plays no part, except in so far as it must be torn to permit the reduction. We depend upon the strength of the humerus and, with firm fixation of the scapula, the force is applied through it to the shortened portions of the capsule. The traction is made in its long axis, and at the upper end the force, driving the head toward the socket, is applied almost directly to the bone. In the Kocher method the main force is applied to the lower end of the humerus, which represents a long lever, the fulcrum being at the attachment of the capsule to the anatomical neck. Of the four fractures produced by Kocher, three were at the upper end of the humerus. He recognized that the external rotation was the dangerous movement. This is eliminated in the abduction method.

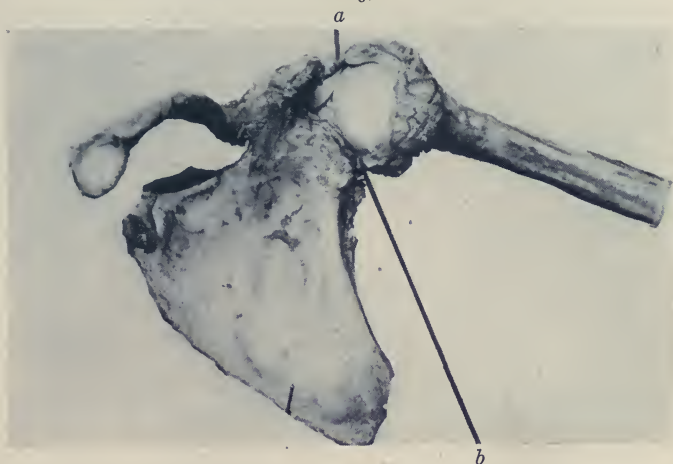
It is generally recognized that the humeral head leaves the socket while the arm is in abduction. In the normal condition, when the scapula is fixed in its position of rest, *i.e.*, the position it occupies when the arm is hanging at the side of the body, the humerus reaches the limit of abduction at about a right angle with the body (Fig. 2). In the dislocation when the arm is in abduction, the head is anterior to and on a slightly higher level than the socket. Therefore, to reduce, the head must first be brought down to the level of the socket so that it can be made to ride over the anterior margin of the socket, outward and backward. The traction on the abducted arm must be strong enough to overcome the resistance of the holding portions of the repaired capsule, and the traction or direct pressure outward and backward on the upper end of the humerus should not begin until the head is thought to be low enough. I know of no exact method of determining this point, but I have an assistant place the finger or thumb of one hand on the head so that he and I can observe approximately its degree of downward movement when the traction is made on the arm and the scapula is firmly fixed. I think it should move about a full inch.

The head ascends to a somewhat higher level in old than in recent dislocations, because of the groove made in the head by the pressure against it of the anterior glénoid margin in the dislocated position. The longer the dislocation persists the deeper will the groove probably be. This groove will at least partly explain the fact that the elbow can usually be brought to the side of the body in old dislocations, while in the recent condition it springs away from the side. Since the resistance is in the fibrous connection between the humerus and scapula, if the scapula is firmly fixed, all the force applied in traction is being exerted on the short or holding portions of the capsule, *i.e.*, exactly where it can produce the best results and the least harm, the resistance offered by these portions of the capsule being the best possible protection against damage to the surrounding structures during the application of the force.

The following is a brief description of the method as I apply it:

Under full ether anæsthesia, I first try to tear some of the resisting capsule fibres by manipulation. The patient is then transferred from the operating table or litter to the floor with several blankets underneath and a pillow for the head. The Allis apparatus, which permits all the traction to be applied to the arm and thus to prevent danger to the elbow and wrist, is then applied. (Two internal angular splints are always available, Figs. 6, 7, and 8.) I then take a sitting position on the floor in such a way that I can brace one stockinged foot against the axillary border of the scapula and the other against the upper border, while pulling on the arm in abduction. An assistant kneels alongside the patient below the arm with the thumb or finger of one hand on the dislocated head of the humerus (Fig. 6). Another assistant may, with a folded sheet, assist the first in forcing the head toward the socket. My first pulls, gradually increasing in force, test the downward movement of the head. When I think it comes down far enough I maintain the traction and ask the assistant to push strongly outward and backward on the head (Fig. 7), and when it seems to pass out far enough I ask him to pull in on the elbow with the

FIG. 5.



Showing the upper (*a*) and lower (*b*) margins of the rent carried forward and inward by dislocated head, which is rolled outward to show them.

FIG. 6.



Abduction method with aid of two internal angular splints and wet gauze bandages. First step: Fixation of scapula by surgeon's feet while he makes traction on arm held somewhat beyond a right angle. Thumb of assistant's left hand marking position of humeral head, the rest of his body being kept as much as possible out of the illustration.

FIG. 7.



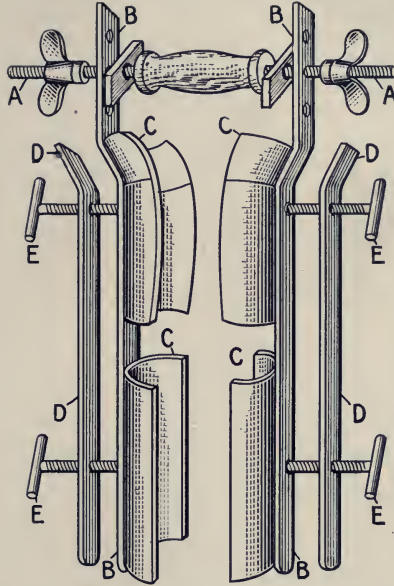
Abduction method. Second step: Head drawn down to level of socket and assistant pushing it toward socket. Folded sheet and second assistant may be employed to aid in this step.

FIG. 8.



Abduction method. Third step: Assistant, while he is still pushing on head toward socket and surgeon is maintaining traction, with his right hand pulls the lower end of the humerus to the side of the body.

FIG. 9.



Allis's instrument for assisting in the reduction of dislocations of the hip. AA, handle with four nuts to secure handle to upright bars, BBBB. CCCC, iron plates riveted to BBBB, and shaped to fit humerus or femur above condyle. DDDD, movable bars that can be approximated to or separated from BBBB. In using, the bars DDDD are first screwed down to BBBB. The bandage is then applied around them and tightened by means of the handles EEEE. Previous to applying the apparatus, a wet bandage should be applied to the limb. It serves a double purpose, in that it protects the part from violence, and prevents it from slipping.

other hand (Fig. 8). I have found that because of my position it is rather difficult to move the elbow inward myself. I have not tried the method without narcosis and I have found it difficult to apply the necessary force by grasping the arm above the elbow with my hands. Dr. Allis's apparatus made for applying traction to the thigh in dislocations of the hip, was an excellent aid in the dislocation of the shoulder (Fig. 9). I have seen Dr. A. C. Wood, however, reduce a dislocation of about three weeks' duration by grasping the arm above the elbow, placing one foot against the axillary border of the scapula, without taking the patient off the litter on which he was lying, without the aid of pressure or traction on the upper end of the humerus, and without giving an anæsthetic. The reduction was made with the first pull, and the patient merely made a slight outcry and then laughed when he found the shoulder in place. I am satisfied that there would have been more pain if the dislocation had been a recent one.

After the dislocation has existed two or three months, I believe that no non-operative method can succeed without the employment of a considerable degree of force, and in many cases very severe force will be necessary. With the abduction method I have described, I believe that a sufficient degree of force can be safely applied to place the head in the socket in most cases. What time limit or other contraindication the method has, I do not know. In the attempt which I made after four years, I was satisfied that the failure was not due to the duration of the dislocation but to the contents of the glenoid cavity, as the movements of the head were quite sufficient to accomplish the reduction. Kocher found this condition in only two of his operative cases, all of which he regarded as irreducible by non-operative methods. In supporting the non-operative method I have drawn upon the experience and suggestions of those with whom I have been associated. In conclusion I wish to acknowledge an indebtedness that is none the less definite because it is based upon memory. For about fifteen years I had the privilege of seeing or assisting Professor J. William White reduce a considerable number of these old dislocations. I have always believed that he was

unusually successful, and after considerable reading on the subject I have been more convinced of it. His rule was to attempt reduction if the dislocation was not more than three months old, and his failures were very few. In my opinion, his success was due to the fact that he persisted, first with one method, usually the Kocher, and then with another, having assistants make traction with a folded sheet and direct pressure in the axilla on the upper end of the humerus toward the socket, and if the various methods failed after the first trial, going back to one or the other, until finally he brought the head into the glenoid cavity. I believe that every failure brought him a step nearer to success by breaking still more the resistance that must be overcome in every case before the reduction can be accomplished, and that he succeeded because he persisted. I am certain that his success was an important factor in bringing me to the conviction that the solution of the problem in this condition was not in early operation on every case, but that in most cases only the proper method and persistency would be necessary to accomplish the reduction.

The effect of the fractures commonly associated with anterior dislocations of the shoulder is still little understood. They are usually the fractures of the greater tuberosity and the anterior glenoid margin. The tendency has been to regard them as leading to insuperable obstacles to reduction without operation and this was rather encouraged by Kocher. My experience with them is small, but it leads me to believe that in most cases we shall be able to overcome by operation any obstacles arising from them, sometimes with, but often without, operation. Two years after reducing my case of four months' standing I operated and found evidences of both fractures. Codman⁸ recently found small fragments of the tuberosity adherent to the glenoid cavity, interfering with the reduction, and he has suggested that in operating on these cases the incision should be made posteriorly. This is undoubtedly true, because by the anterior incision one cannot obtain a good exposure of the glenoid cavity, since the humeral head is in the way. I believe, however, that the capsule resist-

ance should first be broken by traction in abduction, so that when the glenoid cavity is emptied the head can be brought easily into the socket. It might be possible to divide the obstructing portions of the capsule through the wound, but I think it unlikely that it can be done as effectively as by traction on the humerus and fixation of the scapula.

CASES.

CASE I.—Woman, fifty years of age. Dislocation of right shoulder, reduced 8 months after accident. Unsuccessful attempt made at end of three months.

Mrs. M., September 3, 1909, fell headlong down a flight of steps, injuring her right shoulder. Physician diagnosed a sprain. Immobilization for a time and later given electrical treatments and massage. Dislocation recognized three months after accident, and attempt made at reduction under ether. Some months later she came into the hands of Dr. J. Bernard Mencke, who referred her to me April 21, 1910. On April 29, she was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on May 2, which was one week short of eight months after the accident, she was etherized and after breaking up some of the axillary resistance by manipulations, I had her placed on the floor on blankets with a pillow under her head. The scapula was fixed by two long strips of adhesive plaster about three inches wide, one passing over the upper and the other over the axillary border of the scapula, and the ends of each strip held by an assistant. One of these assistants placed his stockinged heel against the head of the humerus. I sat on the floor in such a position that I could pull on the forearm just above the wrist with the arm at slightly more than a right angle with the body. After pulling as hard as I could several times to bring the head down to the level of the glenoid, the assistant pushed with his heel on the head toward the socket and I brought the arm to the side, maintaining my traction in the meantime. After three failures to lodge the head in the socket in this way, I asked another interne to assist me in pulling on the wrist, when the reduction was accomplished. The arm was bandaged in the Velpeau position for three weeks

and then released entirely. Notwithstanding the fact that I had been prepared to use much force, I was concerned particularly about the pressure of the heel of the assistant in the axilla, until on the following day the patient showed little or no discomfort and no signs of injury about the shoulder. At the present time abduction can be carried to about 140 degrees, while external rotation is still somewhat limited. She has no pain and can do most of her housework.

CASE II.—Woman aged sixty years. Dislocation of the right shoulder of 4 years and 3 months, and of left shoulder of 4 months' standing. Reduction on left side, failure on right side. Joint on left side opened 22 months after reduction.

Mrs. R., in the latter part of April, 1906, fell down a flight of stairs and injured her right shoulder. Did not seek professional advice until two weeks later. She then visited a hospital where a dislocation was recognized. She was given an anæsthetic and an attempt made at reduction. The arm was bound to the side and patient kept in the hospital two weeks, when she was discharged and told that everything would come out all right. About the first week in May, 1910, she slipped on a banana peel and fell striking on her left shoulder. About a week later she sent for a physician who diagnosed a dislocation of the left shoulder. With his heel in the axilla he pulled on the arm, after which he said that the dislocation was reduced. The arm was bound to the side for two weeks, but during that time the bandage was removed every few days and the shoulder massaged. Dr. Mencke, at the German Hospital, in the service of Dr. G. G. Ross, who saw her some time later, referred her to me, August 8, 1910, with the diagnosis of a double subcoracoid dislocation, which was readily confirmed on examination and by the X-ray. She could abduct to about 120 degrees on the right side and the usefulness of the limb was very good considering the presence of the dislocation. On the left side she could abduct to about 50 degrees. She was admitted to the University Hospital August 9, 1910, on the service of Professor J. William White, and on August 10 was given ether for the attempt at reduction. She wished me to try to reduce the right shoulder if I succeeded with the left. After placing her on the floor as in the preceding case, a folded sheet was passed around the body transversely so that it covered the axillary border of the scapula and could

be held at both ends by an assistant on the opposite side of the body. Another folded sheet was similarly placed but with its middle over the upper border of the scapula and its two ends passing obliquely downward and to the opposite side of the body where it could be held by a second assistant. In my stockinged feet I sat on the floor in the same position as in the preceding case, but placed one foot against the upper and the other against the axillary border of the scapula, and again grasped the patient's left forearm just above the wrist, an assistant taking hold of the arm just above the elbow. We two then pulled on the arm while the scapula was fixed by my feet and the sheets, until a slight tearing sensation was felt—it was also heard—and the head moved downward to what I thought was the level of the anterior glenoid margin. The assistant holding the sheet passing obliquely downward from the upper border of the scapula then placed one stockinged foot against the upper end of the humerus and pushed the head toward the socket. When it seemed to be in the socket the arm under traction was brought to the side of the body. After two such trials the dislocation was reduced on this, the left side, after having existed for four months.

The right shoulder was treated in the same way but after four or five trials the dislocation was not reduced. There was distinct crepitus, and the X-ray, according to Dr. Pancoast, the skiagrapher, showed a fracture of the greater tuberosity. The head was carried repeatedly over the anterior glenoid margin well up into its normal position, but as soon as the traction and pressure were released it jumped back again into the dislocated position. I am satisfied that the posterior portion of the capsule was adherent to the glenoid surface, probably with a detached fragment of the greater tuberosity so that the cup was filled and the head could not remain in the socket. Kocher called attention to this condition, and other writers, as Lund, have emphasized it. Before the head can be placed in its normal position, the glenoid cavity must be cleared of these structures.

While the force employed in the attempt at reduction in the right shoulder of this patient was greater than in either of the two other shoulders, the left in this case and that of the first case, which were successfully reduced (or in any of

the three successful reductions which followed), it seemed to me that the glenoid conditions and not the prolonged period during which the dislocation had lasted were chiefly responsible for the failure. I would infer, therefore, that while the duration of the dislocation is of importance, the adhesion of the posterior portion of the capsule, especially if it has been detached with a fragment of the greater tuberosity, is of far more importance. After failing to reduce the right shoulder, I bandaged both arms to the side of the body and supported both wrists in slings from the neck. On the following day I removed the bandages and asked the patient to abduct the right arm as far as she could and found that she could do so to about 90 degrees. I asked her if she had much pain in this shoulder and her answer was, "not much." During the night she had had considerable pain in the left shoulder which was reduced, but this had largely disappeared. I had expected to find considerable disturbance, especially in the right shoulder, but there was no noticeable swelling or pain and she permitted me to handle both shoulders, but the right particularly, with considerable freedom.

She left the hospital August 15, and received massage and passive motion at the German Hospital, under Dr. Ross's direction, over a prolonged period. I saw her again for the first time about a year after her discharge. I was surprised to hear her refer to the arm of the side on which I had reduced the dislocation as her "bad arm." The motion was not as good as on the right side where the dislocation remained unreduced, and she had some pain in the left when she tried to move it upward. She was very anxious to increase the movement on the left side. I at first counselled against operation, but as she was a widow and could keep out of the almshouse only by earning her own living, and was anxious to have something done, I concluded to open the joint. The X-ray showed irregularity at the site of the greater tuberosity, and I thought I might find a loose fragment or irregularity, the removal of which would warrant an operation.

She was admitted to the Philadelphia Hospital on the service of Dr. A. C. Wood, and on June 15, 1912, with the patient under ether, I made an incision over the greater tuberosity downward and forward from the anterior margin of the

acromion in the line of the fibres of the deltoid. The site of the subacromial bursa was exposed thoroughly but it had been obliterated. In its place was a layer of fibrous tissue about one-half inch thick, firmly adherent to the greater tuberosity but not to the under surface of the acromion, as was shown by the fact that the tuberosity and the layer of fibrous tissue moved freely under the acromion. In this case, at least, the obliteration of the bursa by adhesions was not responsible for the scapulohumeral limitation of motion. With the finger in the joint later it seemed evident that the limited abduction was due to the tightening up of a contracted axillary portion of the capsule. An incision was made into the joint between the supraspinatus and subscapularis tendons, careful search being made for the long tendon of the biceps, which is in this situation. It was found to have been torn from its attachment at the upper margin of the glenoid, and its torn end was adherent in the lower part of the bicipital groove, the upper end of the groove being obliterated by callus. There were two small bony projections on the upper surface of the greater tuberosity, evidently the result of an old fracture which had reunited. There were no loose pieces of bone here. The bony projections were smoothed off by a chisel. The finger in the joint found a deep groove in the cartilaginous portion of the head just below and internal to the greater tuberosity. The anterior glenoid margin, including about the anterior third of the cup, had been worn away. Imbedded in the anterior portion of the capsule was a small fragment of bone, evidently torn from the anterior glenoid margin at the time of the dislocation. The groove in the head had rested on the worn portion of the glenoid margin during the four months in which the dislocation had remained unreduced, and the wearing away in both bones was the result of the pressure induced by the contact. By manipulations during the operation it seemed evident that the absence of the anterior part of the cup and the groove in the head permitted an abnormal range of movement out of the cup anteriorly, and that the rubbing of the rough portion of the head on the anterior glenoid margin in this abnormal movement was responsible for much of the pain which the patient had experienced. The condition found in the joint explains in a measure why it is so difficult to obtain

full function after the reduction of an old dislocation. The operation, however, did not improve the condition of the patient materially, and she is compelled to remain in the almshouse because of the condition of her two shoulders. The pain, however, on movement of the joint is not as severe as before the operation, and the patient is still improving in that respect as well as in the range of motion.

CASE III.—Young man. Fracture lower third of right humerus and dislocation of same shoulder, of eight weeks' duration. Weak union and refracture of humerus. Reduction of dislocation. Death of patient three months later from lung disease.

Mr. D., referred by Dr. W. S. Cornell. November 9, 1910, while at work in a lumber yard, a pile of boards fell on him. He was taken to a hospital where a fracture of the humerus was diagnosed and the arm immobilized with splints. He was admitted to the University Hospital January 3, 1911, on the service of Professor Edward Martin, when I saw him for the first time and recognized a dislocation which Dr. Cornell had already found. He was etherized January 5 for an attempt at reduction. I was anxious about the character of the union at the seat of fracture, because Dr. Cornell reported that the patient had come to him with a very indifferently applied bandage and a very small internal splint and with no fixation of the elbow or shoulder.

I gently rotated the arm externally and on the first movement a refracture occurred. I concluded, however, to try to reduce the dislocation. It would have been impossible with the Kocher method. I first applied to the forearm a wet gauze bandage, following a suggestion of Dr. Allis. I then padded with cotton and covered with a gauze bandage two ordinary right-angled internal splints, which I applied to the forearm and arm with another wet gauze bandage after soaking the splints in water. One splint was on the inner and the other on the outer side with the padded side of each splint facing the limb. The upper edges of the splints were left free of bandage just on the forearm side of the elbow. The object was to devise an apparatus with which I could make a strong pull that would be confined as much as possible to and in the axis of the humerus, beside providing some immobilization for the fracture. I had

found that by grasping the arm above the elbow with my hands, I could not apply the necessary force, and in the preceding cases I had been concerned lest the traction on the forearm would do some damage to the elbow and wrist. I learned later that Dr. Allis had devised an excellent apparatus for a similar purpose in hip dislocations that is quite as effective at the shoulder and that I used in the last of my cases. With the patient on the floor under ether I took the same position as in the preceding cases, placed one stockinged foot against the axillary border and the other against the upper border of the scapula, and grasped the splints one in each hand where they were free of bandage. A folded sheet was passed around the upper end of the humerus and the two ends grasped by an assistant who placed one foot against the upper border of the scapula. A second assistant placed his hand against the head of the humerus in the axilla. When after pulling on the humerus and watching the hand of the assistant on the humeral head descend as far as I thought necessary, I asked the assistant with the folded sheet to pull and the other to push outward on the humerus toward the socket while I maintained the traction on the humerus. When the head seemed to be going out satisfactorily, I asked the assistant with his hand in the axilla to grasp the elbow with his other hand and pull it toward the side. The first try failed but the second succeeded. The fracture of the humerus was immobilized by an internal angular splint and a shoulder cap, and the arm bandaged to the side of the body.

The ease with which the humerus was refractured eight weeks after the accident gave little hope of firm reunion, so that on January 30, the site of fracture was exposed by an intermuscular incision on the outer side of the arm. The musculospiral nerve was turned aside, the fibrous covering of the fragments curetted away, and the fracture splinted with a Lane plate, a small rubber dam drain being left in the lower angle of the wound. A dressing was applied and an internal angular splint used to reinforce the plate. The shoulder was then exposed for the removal of two small fragments of the greater tuberosity which were loose. The long tendon of the biceps retained its normal attachment, and the supraspinatus tendon from which the fragments were detached was sutured to the

fibrous covering of the humerus. A small opening was made in the posterior part of the joint for drainage of the oozing that could not be controlled. The wound was closed and a dressing applied. A triangular splint was fixed in the axilla and kept the arm at nearly a right angle with the body. Both drains were removed on the third day. Healing occurred by first intention. The patient developed a severe cough after the operation. He gradually improved and left the hospital March 7. The shoulder was in good position and the motion improving. He visited me at my office several times but about a month after leaving the hospital I lost sight of him. He was much pleased with his progress at that time but his cough was still severe. I learned later that he died about three months after the operation. Before operation he had a pale sallow complexion, but he had not complained of being sick and examination did not develop any lung or other lesion. He did not show lung disturbances after the etherization and reduction. I think, however, that he must have had a latent tuberculous lesion in the lung, and that the ether and shock of the operation made it acute.

CASE IV.—Woman, aged fifty-eight years. Dislocation of right shoulder, 16 days old. Reduction.

Mrs. B., on August 20, 1911, fell down three steps, striking on her right shoulder. A dislocation was not recognized until 15 days later. She was admitted to the University Hospital, September 5, on the service of Professor Edward Martin. On that day, an interne made a vigorous effort to reduce by the Kocher method under nitrous oxide anæsthesia, without success. On the following day under ether anæsthesia, I reduced the dislocation easily, with the abduction method, probably because the resistance had been largely broken up by the interne's efforts. The X-ray showed a large fragment of the greater tuberosity widely separated from the head, a condition which, according to Kocher, renders the dislocation irreducible by his method. This probably accounted for the interne's failure. I feared that this fragment would give trouble later from faulty apposition, which fear was not removed by the skiagraph. On September 13, I exposed the greater tuberosity by a three-inch incision downward from the acromion and found that the fragment had fallen so nicely into place that I could find the

line of fracture only on one side and could not detect any irregularity at the site of the tuberosity. The wound healed by first intention and the patient left the hospital on the seventh day after the operation. She now does all of her work as a housekeeper and there is now very little limitation of movement. Her only complaint is that she cannot button her dress in the back quite as well as with the other hand.

CASE V.—Woman, aged fifty-six years. Dislocation of right shoulder 25 days old. Reduction.

Mrs. B., on January 1, 1912, tripped over a piece of carpet to the floor, injuring her right shoulder. The physician who was called thought she was suffering from a fracture and said it was a hospital case. I saw her first January 23, and on January 26 I reduced the dislocation under ether at the University Hospital, on the service of Professor Edward Martin, by the abduction method as in the preceding cases. In this case I employed the apparatus devised by Dr. Allis for applying traction to the hip in dislocations of the hip. It worked perfectly at the shoulder, and permitted all the force to be applied directly to the upper arm. The handles allowed an excellent grip with both hands and easy manipulation of the arm. I did not use a folded sheet, but had an assistant make direct pressure on the head toward the socket, and when it had been forced outward far enough he pulled the lower end of the arm to the side of the body with his other hand. The reduction was accomplished on the second attempt. The arm was bound in the Velpeau position and the patient sent home the same day. I did not see her again for four weeks because she had been ill at home. With the permission of Professor G. G. Davis, she received passive exercises and massage in the gymnasium of the Orthopaedic Department of the University Hospital. She now raises her arm above her head and is well pleased with the use she has of it. She reported by letter, recently, that she was enjoying very good use of the arm.

CONCLUSIONS

The mortality is lower and the average functional result following a non-operative reduction is better than following an operative reduction, but the frequently insurmountable

obstacles and the great force necessary to a successful reduction have led to an increasing tendency toward operation.

The particular obstacle to reduction has never been satisfactorily demonstrated. While Kocher emphasizes other obstacles, as irregular bone formation, his main contention was that the chief resistance to reduction came from the contraction of the margins of the old capsule tear, which had closed about the head and thus prevented the raising of the capsule from the glenoid so that the head could not enter. On the basis of cadaver studies supported by clinical evidence, I believe that the chief obstacle is to be found in the cicatricial tissue at the site of the capsule tear and the shortening of the latter in certain portions, which must be more or less torn before the head can be brought back into the glenoid cavity. The rent in the capsule *per se* is probably never an obstacle to reduction by constricting the neck of the humerus and thus preventing the return of the head.

The Allis principle of reduction is a safer and more effective one than that of Bigelow. According to the former the humeral head is dragged back to the socket in almost a direct line, while by the latter the head is returned by leverage. Kocher, out of 28 cases in which he attempted reduction by his method, reduced 25 and failed in 3, in each of which a fracture of the humerus prevented further efforts. The longest duration of the dislocation was 5 months and 22 days. Of 6 dislocations in 5 patients, 5 were reduced by the abduction method, one of them after 8 months. The humerus was not fractured by the efforts at reduction in any case. While a fracture of the humerus renders an old dislocation irreducible by the Kocher method, one dislocation was reduced after 8 weeks by the abduction method in the presence of a complete fracture of the humerus at the junction of the lower and middle thirds. In the one case in which the abduction method failed, the dislocation had existed for 4 years and 3 months, and there was probably an adhesion in the glenoid cavity of the posterior portion of the capsule with a fragment of the greater tuberosity, a condition which

Kocher considered an insuperable obstacle to reduction without operation. Probably the best method of accomplishing reduction in such a case is first to break the fibrous resistance to reduction by the abduction method and then through a posterior incision to raise the fragment and capsule from the glenoid, when the head can be brought into the socket and the fragment replaced in its normal position, or it may be removed and the remaining capsule sutured in its normal position.

Because of the pressure and other changes in the humeral head and glenoid cavity from the long existence of the dislocation, it will sometimes be best to allow the dislocation to remain unreduced, especially if the limb is fairly useful and without troublesome pain, as in the shoulder in which the abduction method failed. While there was no mortality in Kocher's 28 cases in which no operation was done, in his 8 operative cases there was one death from sepsis. In the 5 cases in which the abduction method was employed without operation, there was no death, but in the case in which there was a poorly united fracture 8 weeks after the occurrence of the dislocation, the fracture was splinted 15 days after the reduction. A latent lung infection, not recognized at the time, was much aggravated by the operation, and the patient died in consequence of it three months after the operation. The indications and contraindications for the abduction method can be determined only by further experience.

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CHRONIC (NON-SUPPURATIVE) HEMORRHAGIC OSTEOMYELITIS.

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SYNONYMS.—(A) Medullary giant-cell sarcoma. (B) Myelogenous giant-cell sarcoma. (C) Myeloma. (D) Medullary giant-cell tumor (Bloodgood).

THE writer has been of the opinion for some time, as the result of a critical study of the literature bearing upon the subject, and of considerable observation of surgical diseases affecting the bones and joints, that the lesion to be described, which has thus far been classified as belonging to the group of neoplasms, is incorrect, and that the terms employed for its description and classification do not properly convey its true nature. In other words, the terms now used for the lesion are misleading, and, therefore, misnomers. The disease occurs in or near the ends of the long bones, and is known under the titles of slow-growing medullary giant-cell sarcoma, myelogenous giant-cell sarcoma, myeloma, and medullary giant-cell tumor. It should be in the group of surgical diseases, classified with the inflammations, or granulomata.

Heretofore the diagnosis of this condition as one of tumor formation has been based, in a measure, upon the presence of a steady, slow increase in size and expansion of the end of the long bone involved. Buerger believes this expansion is more apparent than real, which on section exhibits within the bony shell surrounding it a mass having the general appearance of foreign growth.

The principal reason, however, for giving the lesion its title of medullary giant-cell sarcoma has been based upon the microscopic findings. The histological picture usually shows a microscopic field abounding in giant cells with no architectural uniformity, arrangement, or consistency; they exhibit no limiting boundary, and are invasive in all directions. It is this

microscopic picture of apparent giant-cell riot that has been the main factor in giving to the lesion its title of medullary giant-cell sarcoma, and the sheet-anchor upon which the diagnosis has been based.

It should be borne in mind that these giant cells are not tissue builders, nor causes of tissue necrosis; they are wanderers, and act as scavengers in their efforts to take up and consume, or cause the disappearance of, detritus, resulting from injury or death of tissue. According to Mallory, these giant cells are similar to those found in other pathological processes involving bone. He thinks the evidence is sufficient to demonstrate that these are not tumor cells at all, simply foreign body giant cells. He believes that the osteoclasts which occur in connection with bone under normal and pathological conditions are unquestionably foreign body giant cells originating from fused endothelial leucocytes.

Hertzler believes the diagnosis of sarcomatous growths cannot be made from the microscopic findings. He states: "It must be recognized that there are no positive microscopic signs of sarcoma; it becomes necessary to resort to other evidence than that of the microscope, such as the history and macroscopic appearance of the growth."

Bland Sutton, using the British title given to these lesions (myeloma), states: "A close study of myelomas indicates that they differ histologically, pathologically, and clinically from sarcomas, with which they have been hitherto grouped. Microscopically this tissue abounds in large multinuclear cells (giant-cell myeloplacques) embedded among round and spindle cells; the giant cells are so numerous as to constitute the greater portion of the tumor."

Bloodgood concludes that it might be well to drop the term giant-cell sarcoma, as it gives a wrong impression of its malignancy, and suggests the name of giant-cell tumor; he also thinks there may be some relationship between this pathological lesion and the conditions known as *ostitis fibrosa* and bone cysts, both of which are usually classified as inflammatory. The gross pathological or naked-eye appearance of so-called medullary giant-cell sarcoma, observed as a single slow-grow-

ing lesion in the ends of the long bones, has a most striking and typical aspect that should not be mistaken for anything else when seen in the fresh or during operative interference. After section of the tissues leading to the involved area of bone structure, one is impressed with the general character, appearance, and consistency of the pathological lesion the picture presents.

The mass has a fresh, glistening, reddish appearance that looks like, and really is, very exuberant embryonal granulation tissue and highly vascular. Many of the vessels apparently run in continuity with those of the normal surrounding tissue. The vessels, being without supporting structure, become greatly dilated, and sometimes pulsation is felt throughout the vascular granular mass.

Scattered throughout the vascular granulation tissue may be seen numerous rounded hyaline bodies, varying in size from a grape-seed to that of a pea; these bodies are probably degenerated blood-clots or thrombi. Bloodgood speaks of finding whitish areas of *ostitis fibrosa* within the mass; these areas are evidence of more active focal points of inflammatory reaction. Within the cavity is usually found more or less hemorrhagic fluid. Just how much of this fluid is native to the lesion or how much of it is due to bruising the granulation tissue is hard to say. Exploration at primary operation does not give evidence that any suppurative process ever has been present or is going on. The tissue is very friable and has somewhat the appearance described by the German observers as that of red-currant jelly. Bland Sutton describes the lesion as having the look of a piece of fresh-cut liver. Bloodgood thinks the consistency of the mass to a certain extent resembles "*Schmierkaes*." I think that when red bar-le-duc is added to the cheese the resemblance is still more striking.

There is an undefined smooth velvet effect the tissue gives that is difficult to describe; it is soft and oozes freely on touch; is friable and at the same time gelatinous; its color has the appearance of a very ripe strawberry, and the consistency of the tissue reminds one of that seen on section of brain at recent

autopsy. This picture differs in many respects from any form of tumor growth, but is rather typical of large masses of exuberant, highly vascular granulation tissue.

The lesion practically always occurs in or near the ends of the long bones. To this region Ollier gave the term "the zone of election of pathological processes."

The term osteomyelitis is generally confined to a condition defined as an acute suppurative infectious process beginning in the marrow of the alveolar spaces in the diaphyseal ends of the long bones. The disease is most often seen in children and in young adult life; it follows injuries of moderate or even slight severity.

The clinical picture and forms vary. The most frequent site of the lesion is in the upper end of the tibia. According to Haaga's statistics, 42 per cent. of all cases of osteomyelitis occur in this region, and 39 per cent. in the femur, usually the lower end. Besides the acute infectious suppurative form most commonly met with, Ollier first described acute and chronic non-suppurative forms of inflammation of bone, to which he gave the term *periostitis aluminosa*. The researches of Jaksch, Schlange, Graser, and others indicate that the process is an infective one, that gives no evidence of suppuration. Dennis states that "all the conditions resemble in every respect ordinary suppurative periostitis, only the pus is absent."

Tixier believes the probable origin of this form of osteomyelitis is syphilitic.

Osteomyelitis following typhoid is usually localized as a small abscess with periosteal thickening. *Periostitis aluminosa* gives the same train of symptoms as an ordinary acute attack of infective osteomyelitis, excepting that it seems to progress without suppuration, as does the equally rare sclerosing form. Haaga has seen only 20 cases out of 559 osteomyelitic lesions. Brodie's abscess is another form of mild infective osteomyelitic disease.

The lesion I have termed chronic (non-suppurative) hemorrhagic osteomyelitis gives no picture of acute inflammatory symptoms; it may have, and probably has, an acute stage,

but the symptoms are of so mild a character that practically no physical inconvenience is experienced until many months have elapsed from the time of onset of the disease.

Chronic (non-suppurative) hemorrhagic osteomyelitis has its inception in the same areas of bone structure as the acute form; the process of bone disintegration is much slower, but just as effective, in cancellous tissue destruction. In the acute form, rapid necrotic and suppurative changes take place as a result of the absorption of virulent toxic substances which have the effect of an almost immediate destructive sequelæ.

In this chronic form of osteomyelitis, the process is so slow, due to a probable mechanical-pressure necrosis, that there is no suppurative evidence of cellular death, but abundant proof of attempts at repair and regeneration in the presence of granulation tissue. Going hand in hand, are observed continuous trauma from pressure necrosis, and the death of delicate bony cancellous structure, and regeneration with efforts at repair by the formation of granulation tissue.

Adami states that the predominant feature of a chronic inflammation is essentially tissue overgrowth, and more particularly overgrowth of the least differentiated elements of a tissue. Even in the lowest grades of inflammation, it is probable that there is always some dilatation of the blood-vessels, some migration of leucocytes, and some increased exudation, but these may be so slight as to pass unnoticed in comparison with cell proliferation.

Granulations that persist as such for a long time, without becoming changed into connective tissue, are seen in the specific infections; these fungoid formations of granulation tissue are frequently termed granulomata. The rôle of the giant cell in inflammatory lesions is important; their appearance in great numbers is an evidence of a low-grade, non-suppurative form of inflammation. They are not observed in the virulent acute inflammatory processes; they are essentially the accompaniment of chronic disturbances. The giant cell takes no part in tissue formation; according to Kolliker, giant cells (myeloplacques, osteoclasts) are formed in the bone-marrow

normally. They are found in normal tissue in Howship's lacunae.

Ziegler describes their function in part as follows: "If dying, or necrotic, portions of tissue are too large to be taken up by the leucocytes or proliferating tissue cells, there often develop in the granulation tissue formed in their neighborhood multinuclear giant cells which arrange themselves on the surface of the foreign body or the superfluous tissue mass in exactly the same manner as in the case with the osteoclasts under physiological conditions. If the bodies are not too large they may be taken up by the multinuclear cells, otherwise the cells remain clinging to the surface. The giant cell (under certain chemotactic properties caused by injury and low-grade inflammatory conditions) seems to be evolved from the endothelial cells, and possesses phagocytic properties."

Giant cells are found in abundance around ligatures in the absence of visible pus. They are also in lesser degree the accompaniment of syphilitic and tuberculous lesions, beyond the neighborhood of necrosed structure.

We may conclude that the presence of numerous giant cells is an evidence of a low-grade inflammatory process at which efforts of regeneration are taking place coincident with their presence in the tissues.

It is only in low-grade, non-suppurative conditions that the chemotactic properties of the blood call forth their overproduction, and, further, their *sole* function is the removal of injured or dead extraneous products surrounded by or embedded in granulation tissue; they should neither be credited with nor accused of the ability to form tumor growth. An overproduction of granulation tissue, the result of more or less constant irritative changes that take place within the bone, should not be regarded as true tumor growth; it would be just as reasonable to call exuberant granulations occurring in the wounds of the soft parts tumors as in these cases. The process of repair in bone is slow compared with that of the soft parts, as is evidenced in fractures.

If a fracture is complete, there is an immediate extravasa-

tion of blood between the ends of the fragments and torn periosteum; the blood-clot formed makes a connecting bridge, and especially a support, for the new granulation tissue, which later becomes fibrous and bony, forming callus.

In the condition under consideration, operative findings indicate that the spaces left by destruction of the cancelli are not primarily filled by blood-clot, but by direct proliferation of granulation tissue. It is possible that granulation tissue remaining as such, and which is more or less continuously proliferating, may reach a stage that will bring about regressive degenerative changes from which the malignant neoplasms arise. In such event, we have a changed clinical, gross pathological, and microscopical picture.

Some of the clinical facts regarding osteomyelitis and so-called medullary giant-cell sarcoma are in many respects strikingly similar. In points of distribution of the disease, the ends of the long bones are the favorite site. Von Bruns and Nichols find that osteomyelitis most frequently occurs in children and adolescents, the favorite age in 50 per cent. of the cases being between 13 and 17 years.

In Bloodgood's series of cases of so-called giant-cell sarcoma, and those he collected from the literature, the ages varied from $2\frac{1}{2}$ to 66 years.

Bland Sutton, who describes the condition under the title of myeloma, states that its occurrence is rare over the age of 25 years.

There cannot be much doubt that chronic (non-suppurative) hemorrhagic osteomyelitis frequently occurs in children as a result of injury to the ends of long bones, and that the reparative processes are sufficiently active to prevent any progressive chronic stage. The condition so often diagnosed by the general practitioner as early tuberculosis of bone, with rapid cures, if more often examined by the X-ray, would be found to belong to this form of osteomyelitis. From the histories recorded, these lesions give the duration of the disease as having lasted from several months to several years. Their increase in size is very slow and spheroidly expansile. It must be very rarely that the mass breaks through its capsule.

A slight trauma can be the starting point of grave osteomyelitic infection, dependent upon the lowered resistance of the host and the virulence of the bacterial invasion; such trauma may also be the forerunner of a low-grade, mild inflammatory process in which destruction is constantly going on and regeneration fails to respond in a sufficiently active way to replace the cancelli with more than a primitive granulation tissue. Should regeneration be sufficiently active to convert granulation into connective tissue, a more advanced stage of the primary process takes place, causing retraction of structure and the development of so-called *ostitis fibrosa*, with or without cyst formation.

Several experiments made by Ullman showed that the application of a temporary ligature to an animal's leg for from 10 to 14 hours resulted in changes occurring in the marrow of the bones, particularly extravasations and circumscribed hemorrhages.

Warren believes that some slight injury, such as a kick given by a playmate, or a sprain, is sufficient to produce in the delicate tissue, with its rich vascular supply, a bruising of the vessels and an effusion of blood, causing a certain amount of damage which interferes with the nutrition of the part. Minute fractures of bony trabeculæ are not infrequently found after such injuries.

It is quite easy to understand that destruction of the trabeculæ will have a pathologic effect on the venous sinuses that are supported by it, causing thinning of the vessel walls and their dilatation and varicosity, and further leading to transudation and possible rupture. The varicosed and dilated vessels are also a constantly active cause, with the aid of the granulation tissue in which they are enmeshed, in the further progressive destruction of the bony canals from pressure necrosis, and the ever-present, low-grade chronic inflammation stimulates the reticulum of the bone-marrow to increased proliferation of granulation tissue.

The clinical diagnosis of chronic (non-suppurative) hemorrhagic osteomyelitis can be made from the age of the patient, from the duration of the lesion (a slow, chronic inflammation

lasting months or years), and from the symptoms, the onset usually being the result of a trauma of slight or moderate severity. Pain is not a marked symptom until noticeably increased swelling around or near the joint is observed; tenderness is constantly present from first symptom of onset.

The X-ray picture, properly interpreted, is a valuable aid in the diagnosis. The appearance of the mass in the fresh and gross is typical; it is that of a very vascular granulation tissue without supporting fibrous structures; it is deep-red in color, seems to ooze without being touched, and has scattered areas of hyaline thrombi and some recent blood-clots in the smooth mass of somewhat myxomatous consistency. There may or may not be areas showing connective tissue of higher development and patches termed *ostitis fibrosa*. Heretofore the confirmatory diagnosis of this granular mass as one of tumor formation and type of tumor has been made from the microscopic picture.

The surgeon has been led away from the clinical findings in these cases, and astray by the cellular pathologist, who now informs us that these giant cells are not tumor cells.

CASE I.—I am under obligations to Dr. P. W. Roberts for the privilege of reporting this case, and for the opportunity of assisting in the primary operation.

Patient, Miss O. S., age 28 years. She had been treated for over a year previous to examination for right sacro-iliac strain by the use of liniments and strapping with adhesive plaster; no treatment was given to the knee. Several physicians informed her that the trouble was in her right hip. The onset of the trouble was pain radiating from the pelvis to the right knee. There is no history of a direct trauma. The knee has gradually assumed a flexed position.

Examination reveals a right sacro-iliac strain; the right knee is in flexion at an angle of about 45 degrees, the knee-joint is somewhat enlarged and tender to touch. Both hip-joints clear and freely movable. Patient was advised to have flexion of the knee corrected, which later was done under anæsthesia and the entire limb put up in plaster-of-Paris dressing for six weeks. Pain decreased and patient was able to walk with aid of a

brace for about three months, at which time she again came under observation, complaining of tenderness and pain on pressure at the knee, and showed, on examination, increased enlargement of the lower end of the femur.

The X-ray (Fig. 1), taken six months after correction of flexion, shows a soft area about the size of a pigeon's egg, with a clearly circumscribed, though slightly irregular, outline, at the diaphyseal end of the right femur, and dipping below the epiphyseal line of the internal condyle, the shadow shows a very evident pathological process of the bony trabeculæ. The initial focal point, lying exactly in the area of election described by Ollier, is beautifully seen in the X-ray; it is situated in the diaphyseal portion of the bone, and its lower border just touches the epiphysis; there is total bony destruction of the cancellous tissue about the size of a pea, which gives the deep shadow in the picture.

Operation.—After section of the soft parts, an opening window was made in the bone sufficiently large to expose the lesion; it was seen to be hemorrhagic and had the appearance of exuberant granulation tissue; the mass had a smooth velvety look, and the consistency of sectioned fresh autopsy brain tissue; it was deep-red in color, somewhat that of a ripe strawberry.

On curetting out the mass, it was found to contain numerous hyaline bodies, rather rounded and varying in size from a grape-seed to a small pea. On slight pressure, a serosanguineous fluid would exude from the mass removed by the curette. There was no evidence of fibrous tissue-supporting structure. On digital examination of the cavity left after curetting, it (the cavity) was found to be smooth walled and oblong in shape, the size of a bantam's egg; another smaller, thimble-shaped cavity was felt in the internal condyle, also smooth walled.

There was no sign or evidence of suppuration or suppurative foci. The piece of bone removed for making the window with its inner border tissue covering was sent to the laboratory for microscopic examination. The report is as follows:

Examination of tissue from distal end of femur.

One small piece of bony tissue surrounded by a softer tissue, dark yellowish-brown in color.

Microscopic Examination.—The softer tissue consists of a rather loose fibrous structure which is infiltrated to a moderate degree with small

round and epithelioid cells and free blood-cells; on one side there is a comparatively large amount of blood-clot. There are no distinct areas of generation, but in the search of a relatively large number of slides a few well-defined giant cells were found containing 8 to 12 nuclei.

The cavity of the bone was packed and occlusive dressings applied; some days later increased temperature was observed and infection noted; the wound continued to discharge for six weeks, when closure took place.

Comment.—This case is as typical an illustration of a so-called medullary giant-cell sarcoma in the end of a long bone as it is possible to obtain. The patient is rather over the age Bland Sutton pins his faith upon, but in Bloodgood's series the ages range from $2\frac{1}{2}$ to 66 years.

The duration of the lesion is uncertain; the patient had complained for several years of some radiating pain between the pelvis and knee-joint. Several physicians assured her that the trouble was in the hip. She gave no history of trauma.

It is a question whether or not the correction of the flexion which was done several months before the X-ray picture, which shows the lesion, was taken may not have been the initial traumatic cause of the focal injury in the lower end of the femur. The point is in doubt, because previous to the forcible correction of the flexed knee the joint was enlarged and tender.

CASE II.—Pauline D. W., female, age $5\frac{1}{2}$ years. Came under observation at the Hospital for Ruptured and Crippled on the service of Dr. W. R. Townsend four months ago, with a history that two months previously she had fallen or been knocked down, injuring her right elbow. The mother of the child stated that the patient had been under treatment in another dispensary for several weeks following the injury, and that an operation was advised, which she (the mother) declined.

Examination.—The right elbow showed swelling and tenderness on pressure, with marked pain on rotary movement of elbow-joint. No X-ray was taken, but a diagnosis of ostitis of ulna at the acromial end was recorded, and the arm and forearm put up in a plaster-of-Paris dressing. These dressings have been renewed from time to time. Before each reapplication, the lesion has been examined and improvement noted.

FIG. 1.



Chronic hemorrhagic osteomyelitis (non-suppurative) Femur. (Case I.)

A.

FIG. 2.

B.



A. Normal. Chronic (non-suppurative) hemorrhagic osteomyelitis. Ulna. (Case II.)

FIG. 3.



Tibia, before operation. (Case III.)

FIG. 4.



Tibia, six months after operation. (Case III.)

Final dressing removed three days ago; examination shows practical absence of swelling, circumferential measurement at site of lesion is $\frac{3}{8}$ inch greater than on opposite forearm; no pain or tenderness; slight enlargement of involved bone; no restriction of motion in the joint.

Patient considered clinically cured. X-ray (Fig. 2) taken two days later shows very clearly the lesion in the acromial end of right ulna.

CASE III.—Through the courtesy of Dr. Henry Ling Taylor I am able to report this case.

J. O. B., white, age 21 years. Health good; Neisser infection $1\frac{1}{2}$ years ago; struck left ankle and became lame 13 years ago. One year later pain in front of left ankle, which would come on gradually and last three or four days; resting the leg would make pain pass away. There never was any redness or heat in the part, but some swelling in front of the ankle. No chills or fever.

Wore a brace nine years ago for one year, and was free from pain during that time. Since leaving off brace has had renewed attacks like above four or five times a year. X-ray shows internal malleolus and adjacent part of tibia enlarged (Fig. 3). These are two thin spots in tibia at site of points of tenderness on pressure of ankle.

Clinical Diagnosis.—Chronic osteomyelitis of left tibia near ankle.

Operation (April 26, 1912).—Bone exposed and cut into, a mass of soft grayish material was scraped out which had filled the cavity now seen above the ankle-joint. The bone was chiselled to a depth of more than $\frac{1}{2}$ inch and a second mass of the same material removed, leaving another space about the size of a bean. Wound later became infected; June 13, 1912, well. (Fig. 4.)

These three cases are very instructive, inasmuch as they illustrate the early and late pictures presented in chronic (non-suppurative) hemorrhagic osteomyelitis.

In Case I the femur, the earlier stage of the process, is seen with its excessive formation of primitive exuberant granulation tissue and great vascularity coincident with destruction of bony trabeculæ. It is the appearance of the lesion

in this stage, with its attendant microscopic giant-cell picture of invasion, that has earned for it the title of medullary giant-cell sarcoma.

Case II, the ulna shows the late stage of the process, in which the granulation has been converted into fibrous tissue, causing retraction and leaving cystic areas, giving the lesion the appearance of the so-called *ostitis fibrosa*.

Case III, the lesion in the tibia gives evidence, from its macroscopic appearance, of a late stage of the disease; the mass is described as soft grayish material without sign of necrosis or cysts; solid material encased in bone. The vascular primitive granulation tissue has been converted into structure that apparently is not so densely fibrous as in Case II, is not so firm, and is not cystic; neither is it hemorrhagic, nor has it the naked-eye appearance of Case I. The so-called medullary giant-celled sarcoma and *ostitis fibrosa*, with or without cyst formation, are apparently different stages of the same lesion, the latter being Nature's final effort at repair.

The treatment generally of chronic (non-suppurative) hemorrhagic osteomyelitis should be operative, the operation including only the removal of unhealthy and excessive granulation tissue and inflammatory débris.

The early treatment by fixation in plaster-of-Paris dressing may be effective, the part being put at absolute rest in the same manner that tuberculous lesions of bone are treated, or simple fractures. The insult of operative interference and removal by curettage of the pathologic mass from within its bony cavity stimulates the more active properties of the tissues to regeneration of fibrous cellular tissue structure.

Firm packing or plugging of the wound cavity following operation, causing closure of the dead space, prevents the riotous spreading of soft granulation tissue that occurs in the process of the disease.

The method and technique of Bloodgood is radical and efficient. (Curettage and packing has been the method used in a majority of the cases recorded by the Germans for many years.) The transplantation of a piece of bone into the bony

cavity that remains after removal of the soft pathological tissues, as advised and performed by Bloodgood, is novel and should hasten repair in what is at best a slow-healing process.

The use of the Esmarch bandage for the control of hemorrhage during the operation seems to be a good plan.

The use of pure carbolic acid, followed by alcohol, or of chloride of zinc, to destroy the tissue left behind by the curette, does not seem to be necessary, and must retard the normal healing process. It is better to use the ordinary tincture of iodine for swabbing the cavity thoroughly; it is not destructive to tissue, but, acting as an irritant, stimulates the growth of healthy granulation tissue, which becomes fibrillous and fibrous, retractive and firm, as a result of proper packing or plugging.

If the cavity left in the end of the bone after curetting is not too large, the plumbierung of Mosetig-Moorhof or the bismuth paste of Beck should be used; they act as a plug and control the overactivity and exuberance which granulation tissue frequently assumes in dead spaces; packing the cavity with gauze has the same effect.

The treatment with Coley's serum, or the attenuated streptococcic serum recommended by Wyeth, may have some effect in promoting increased tissue reaction, but the use of either does not seem to be necessary.

The essentials are the application of the ordinary surgical procedures for the removal of detrimental inflammatory products.

Amputation without real evidence of sarcomatous degeneration, which these cases rarely give, is uncalled for.

CONCLUSIONS:

1. The lesions in the ends of the long bones described as medullary giant-cell sarcoma, myelogenous giant-cell sarcoma, myeloma, and giant-cell tumor should not be included in the classification of tumors.

2. The process begins as the result of a trauma, and gives all the clinical and pathological evidence pertaining to a low-grade inflammation.

3. The foundation upon which the diagnosis of malignant tumor growth has been based is the presence in the tissues examined under the microscope of numerous giant cells which do not show any uniformity of architectural arrangement or boundary zones. It is an established fact that these giant cells are not tissue-builders, but scavengers, whose function is the removal of débris that is produced by low-grade inflammatory conditions occurring in bone.

4. The whole process is explained on the basis of the lesion being due to a low-grade, ever-present irritation or inflammation, which causes excessive production of vascular granulation tissue masses.

5. From the clinical picture and the gross and microscopic pathology the condition presents, the term chronic (non-suppurative) hemorrhagic osteomyelitis seems a more correct definition of the lesion than the terms now in use.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated Meeting, Held at the New York Academy of Medicine,
November 13, 1912.*

The President, DR. CHARLES L. GIBSON, in the Chair.

ARRESTED DEVELOPMENT OF THE FOREARM FOLLOWING OSTEOMYELITIS IN CHILDHOOD.

DR. WALTON MARTIN presented a girl, 20 years old, who had been admitted to the Roosevelt Hospital, in the service of Dr. Joseph Blake, six years ago. The history obtained was that when she was a year old she had an osteomyelitis of the forearm for which she had been under treatment at the Randall's Island Hospital for five years. The affected forearm was about one-fourth the size of that on the opposite side, and was curved to the radial side. The hand on the affected side was about the size of the hand of a child of three or four years.

An X-ray plate showed that the shaft of the radius was represented by only a small, thin portion of bone; the ulna was fairly well developed, but had grown in a curve toward the radial side.

On December 16, 1905, under ether anæsthesia, the ulna was divided, and an attempt was made to straighten the forearm. The arm was put up in a plaster-of-Paris dressing. The wound healed by primary union, but an X-ray, taken two months later, still showed marked curving of the ulna. On February 7, 1906, a wedge of bone was removed from the ulna, and a V-shaped plastic operation was carried out through the soft parts on the radial side. The arm was then brought into a much better position. The plaster splints were removed after eight weeks and passive motion and massage given two or three times weekly by Dr. Bartlay. This treatment was continued for several months. The patient soon began to use the hand, which had increased in size so that it is now about one-half the size of its fellow. She was able to use it in sewing and in her daily work. The X-ray showed that the shaft of the ulna was now straight.

Dr. Martin called special attention to the marked growth in the hand after the correction of the deformity in the forearm.

TUBERCULOSIS OF THE SHAFT OF THE ULNA.

DR. MARTIN presented a boy, two and a half years old, who was brought to St. Luke's Hospital last August. Examination showed that the left forearm was enlarged, the overlying skin being normal. The swelling was firm and confined to the ulnar side. There was tenderness on pressure over the lower half of the ulna. An X-ray plate showed that the lower half of the shaft of the ulna was made up of a large cavity covered by a thin shell of bone. The neighboring joints were not involved.

On September 4, 1912, an incision was made in the forearm over the posterior border of the ulna. Upon exposing the bone, the lower half of the ulna was found to be much enlarged. The shell of bone was thick on the ulnar side, thin on the radial side. On this side the bone had been perforated, and thin, tuberculous pus filled the cavity and had burrowed underneath the periosteum, separating it from the bone.

The lower half of the ulna was removed, leaving the thickened periosteum on the radial side. The wound was then closed without drainage, and the arm placed in a plaster-of-Paris dressing. The boy made an uneventful recovery, and X-ray plates, taken, respectively, 50 days and 66 days after the operation, showed a rapid regeneration of the shaft. The new growth of bone could be plainly seen extending along the side of the preserved periosteum. The patient was now able to use the arm in a normal manner and there was no evidence of any disease in the forearm at present.

TUBERCULOUS MESENTERIC GLAND.

DR. JOHN ROGERS presented a man, 36 years old, who came to the hospital with a history of pain in the abdomen, which had persisted for several months. The pain was located to the left of the umbilicus; it was inconstant in character. The bowels were constipated.

Examination revealed a small, tender mass lying just to the left of the umbilicus; it moved freely with the movements of respiration and was not fixed to the abdominal parietes. An X-ray was taken, which showed quite clearly a small mass lying just to the left of the umbilicus and resembling a calculus in the lower pole of the kidney. The diagnosis that seemed most

probable, however, was that of a fecal concretion in a diverticulum of the colon, but upon opening the abdomen the mass proved to be a cheesy lymphatic node of the mesentery. After dissecting it out, it was found to contain a few spicules of calcified degenerated material. The patient's recovery was uneventful.

DR. WILLY MEYER said that several years ago he reported the case of a woman who had been operated on for tuberculous mesenteric glands. She was originally operated on for enlarged glands in the iliac region, which extended alongside the iliac vein down to the groin. These glands had partially broken down and were thoroughly removed. Several months later the patient returned, complaining of severe pain in the abdomen, to the right of the umbilicus, over an area which on examination showed rigidity and tenderness. Upon opening the abdomen, several cheesy and partially calcified tuberculous glands were found in the mesentery of the small intestine, similar to the one described by Dr. Rogers. That patient also made a good recovery and has remained well up to date.

TRAUMATIC RUPTURE OF THE GASTROHEPATIC OMENTUM.

DR. A. V. MOSCHCOWITZ presented a boy, seven years of age, who was admitted to the Mt. Sinai Hospital on October 7, 1912. Just prior to his admission the child was run over by an express wagon, the two side wheels of which passed over the centre of the abdomen from left to right. The child was in deep shock. The entire abdomen was rigid. No blood was found in the urine.

Measures were taken to overcome the shock, and gradually the boy improved to such an extent that it was hoped that no operative interference would become necessary. On the third day, however, symptoms of intestinal obstruction appeared and could not be overcome. There was marked distention of the abdomen, with movable dulness in both flanks.

Operation, October 11, 1912: A median epigastric incision was made, to which subsequently a transverse incision was added. On incising the peritoneum, a large amount of clotted and fluid blood escaped. All the organs were thoroughly examined, and the only lesion found was a vertical tear in the gastrohepatic omentum, about two inches in length, which was evidently the source of the hemorrhage. The tear was repaired, and barring deep post-operative collapse the boy made an uneventful recovery.

In presenting this case, Dr. Moschcowitz called attention to the unusual nature of the injury found at operation, and to the transverse incision, which he had recently employed in a number of cases, and which had given him an excellent exposure and also had healed rapidly and without the formation of hernia.

ILEUS, SECONDARY TO SEPARATION OF THE SMALL
INTESTINE FROM ITS MESENTERY.

DR. MOSCHCOWITZ presented a girl, six years of age, who was referred to him by her family physician on September 3, 1907, with the following history: Eight weeks prior to that time the child was run over by a wagon, the two side wheels of which passed over her abdomen, approximately in its middle; it was not known whether the wheels passed from right to left, or *vice versa*. The child was removed to a hospital and an immediate operation was advised, but this was refused by the mother and the girl was taken home.

About two weeks after the injury the child was apparently perfectly well; there was no vomiting, she had a good appetite, and wished to leave the bed. About that time she began to vomit and complained of pain in the abdomen. This condition grew progressively worse; the vomiting became more frequent, and the bowels were constipated, although minute quantities of fæces were passed every day. A condition of oliguria and great emaciation set in. Almost from the beginning the mother noticed the presence of elevations and depressions upon the abdomen during the attacks of pain.

On physical examination it was found that the abdomen was distended, tympanitic in the centre, with movable dulness in both flanks. Approximately, about once in five minutes borborygmi were heard, and the child complained of severe pain. During these attacks, peristaltic waves were distinctly outlined. The main direction of these waves was perpendicular; their duration was about one minute, and they could readily be elicited by palpating the abdomen.

An immediate operation was advised, and the abdomen was opened through a median incision. A quantity of clear fluid escaped. The colon was found collapsed, showing that the obstruction was proximal to the ileocæcal valve. On being traced, a small convolute of small intestine was found, bound together by omentum and adhesions, into which terminated dilated and collapsed intestine. At the apex of the dilated segment of gut

there was a separate protrusion which could be readily invaginated into the intestine. It appeared to be composed of serosa and mucosa only.

As the child's condition did not warrant extensive manipulation or examination, Dr. Moschcowitz was satisfied to make a hurried entero-enterostomy with a Murphy button between the nearest dilated and collapsed intestine. The patient made a satisfactory recovery from this operation. She was kept in the hospital for two months, however, because the button failed to pass, but was finally discharged on November 2, 1907.

She was re-admitted on January 5, 1908, for the purpose of removing the retained Murphy button. In the interval she had been quite well, barring an occasional attack of colic. On bimanual examination the button was distinctly felt in a loop of intestine, lying in the cul-de-sac of Douglas.

On the following day an incision four inches long was made through the right rectus, and a finger introduced into the peritoneal cavity immediately brought up without difficulty the loop containing the Murphy button, the latter being loose and freely movable in the lumen of the gut. Search was then made for the entero-anastomosis, and this was readily found. The conditions of the surrounding structures were defined with difficulty, and as near as could be ascertained, they were as follows:

The proximal portion of the intestine, that containing the button, was thick-walled and about an inch and a half in diameter; the distal portion was of normal thickness and about three-quarters of an inch in diameter. The proximal portion of the intestine had a mesentery extending up to and including the anastomosis; here it terminated in an apparently cicatrized edge. The first four inches of the distal portion of the intestine were absolutely devoid of mesentery, not even a trace of it being seen. This segment of the gut, however, was completely surrounded by and wrapped up in the thin and fat-free omentum. To accomplish this, the omentum passed through a hiatus in the mesentery in an upward and backward direction. Its exact nature was not ascertained for fear of breaking up any adhesions which might interfere with the viability of the intestine. In the mesentery, just beyond the anastomosis, there was to be seen a triangular hiatus, about four inches to a side, with its apex toward the root of the mesentery. The sides were formed, therefore, by mesentery and intestine, covered by omentum.

No difficulty was experienced in clamping off and incising

the intestine and removing the button. The patient made an excellent recovery, and was discharged in fifteen days. Since then she had been kept under observation and had remained in perfect health.

The interesting features of this case, the speaker said, were, first, the nature of the injury. Second, the nature of the intestinal obstruction, and, finally, the unimpaired viability of at least four inches of small intestine, which was kept alive by the omentum with which nature had surrounded it. The possibility of this, as was well known, had been established by experimental research, but not to the extent of four inches.

DR. MOSCHCOWITZ, in reply to a question, said he presumed, that in the case he had reported, the omentum formed adhesions very rapidly after the intestine was torn away from its mesentery. The integrity of the isolated segment of gut was probably sustained by its omental covering, although this nourishment was not sufficient to prevent the lumen of the intestine from becoming partly obliterated.

CYST OF THE CEREBELLUM.

DR. MOSCHCOWITZ presented a school-boy, fifteen years old, a native of the United States, who was admitted to the Mt. Sinai Hospital on June 9, 1911. He had scarlet fever, measles, and pneumonia as a child, and a year ago he had what was presumably an attack of gripe. Three months prior to his admission he began to complain of severe headaches, which occurred on the slightest exertion and lasted for five or ten minutes. The pain was localized in both temporal regions and was always either preceded or accompanied by vomiting. Recently, diplopia had been noticed and that his memory was becoming defective. He also complained of dizziness, with a tendency to fall forward.

A general physical examination was negative. A special examination made by Dr. I. Abrahamson, the associate neurologist of the hospital, revealed the following points of interest: The head was rotated slightly to the right, and the mouth was drawn to the same side. The entire left face was slightly flattened. The right orbicularis palpebrarum was stronger than the left; there was some weakness of both external recti, with a slight convergent squint and diplopia. There was increased percutaneous and palpatory tenderness over the right occiput. There was ataxia of all the extremities, more marked on the right side.

The left lower extremity was much weaker than the right. The gait was uncertain, and there existed a tendency to fall forward and to the left.

An examination of the eyes made by Dr. J. Wolff revealed in the left eye a marked choked disk, with numerous hemorrhages, the retinal arteries being attenuated and the veins dilated; in the right eye there was a large hemorrhage covering the greater portion of the disk and masking the choked appearance; a large clot extended downward and forward from the disk into the vitreus.

Based upon these symptoms and signs a diagnosis of tumor in the right lobe of the cerebellum was made, and an extensive decompression operation decided upon. On June 17, 1911, an 8-inch curved incision was made over the occiput, with its convexity upward. The flap was retracted downward. The skull was perforated with the Hudson trephine, and most of the occipital bone, with the exception of a small tongue in the median line, was removed, including the posterior margin of the foramen magnum. The dura bulged markedly, and was incised in the form of the flap on both sides.

Dr. Moschowitz said he was just about to close the wound, being satisfied with the extensive decompression, when he decided to explore the cerebellum with an aspirator, and was surprised to find a cyst containing two ounces of clear fluid. The cyst was incised and evacuated, and the cavity then wiped out with tincture of iodine. After inserting a few strands of iodine catgut for drainage, the wound was closed.

The patient's fundi were again examined by Dr. Wolff three days after the operation, and he reported that the hemorrhages were being absorbed, but that both disks were still very much choked, with no appreciable diminution of the swelling. On June 28, however, he reported a decided improvement; both disks were still somewhat blurred, but the swelling was much less than before the operation. On June 24 the patient was examined by Dr. Abrahamson, and he reported improvement in every respect.

The patient left the hospital on July 1, fourteen days after the operation. He had since been kept under observation, a period of almost a year and a half, and at the present time, with the exception of a cerebral hernia and a slight halt in his speech, he was normal in every respect.

In connection with this case, the speaker said, the interesting question arose, Was the good result obtained due to the evacuation and obliteration of the cyst or to the extensive decompression?

DR. WILLY MEYER said that about a year ago he reported a case very similar to the one shown by Dr. Moschcowitz. The patient had all the symptoms of a cerebellar tumor, but upon opening the skull nothing was found, and after several aspirations, which gave no result, the wound was closed. The patient died, and at the postmortem a cavity containing at least five ounces of a clear serosanguineous fluid was found in the posterior part of the left large cerebral hemisphere, overlying the cerebellum. Were it not that indiscriminate aspiration of the brain is so often followed by severe lesions due to hemorrhage, it certainly would have been easy and possible to have struck and drained this cavity. This case had been diagnosed as one of cerebellar tumor.

DISLOCATION OF THE HEAD OF THE RADIUS COMPLICATED BY FRACTURE OF THE ULNA AND VOLKMAN'S ISCHÆMIC PARALYSIS.

DR. ARTHUR L. FISK presented a girl, 23 years old, who, while riding horseback on July 26, 1910, was thrown, and when she struck the ground the left arm was twisted back of her. A fracture of the ulna at the junction of the upper and middle thirds was made out, and the swelling about the elbow, which was very pronounced, was thought to be due to an effusion. On July 28 a fluoroscopic examination was made of the elbow-joint; it was pronounced to be uninjured, and an X-ray plate was taken of the fracture of the ulna only. The case was treated, therefore, as a simple fracture of the ulna.

The pain in the arm was constant and intense throughout the entire time that the splint was worn, and it was found to be impossible to flex the forearm to a right angle. On October 19, 1910, two X-ray photographs were taken of the elbow and forearm, from which it was discovered that there was a dislocation of the head of the radius forward and upward in addition to the fracture of the ulna, which had united at an angle. When Dr. Fisk first saw the case, about ten days later, he found a dislocation of the head of the radius forward and upward; also an old united fracture of the ulna, with angular deformity, and a Volk-

man's ischæmic paralysis of the muscles of the forearm, wrist, and hand, so extensive that these were without function and the fingers were *en griffe*.

Dr. Fisk operated on November 5, 1910, making an incision about seven inches long over the site of the fracture of the ulna on the posterior aspect of the forearm, and extending down to the bone. The ulna was re-fractured along the line of union. Then reduction of the dislocation of the radius was attempted, but found to be impossible. The incision was thereupon extended upward and outward, so as to open into the capsule of the joint, and the head of the radius was found to be outside of the anterior ligament of the joint, which had become so firmly adherent that reduction could not be effected. The anterior ligament was then incised, and the head of the radius drawn through. Even then reduction could not be accomplished because of the retraction of the muscles, which were also firmly bound up in the ischæmic paralysis, so that the head of the radius could not be brought down to the capitellum. The head of the radius was therefore excised and the ends of the ulna squared off and wired. The capsule of the joint and the wound were sutured without drainage, and the arm put up at a right angle with the hand in supination. This splint was left on for two weeks. It was then taken off, and the forearm, wrist, and hand treated with massage and electricity every day to overcome the Volkman's paralysis, which was becoming more and more aggravated. On January 16, 1911, it was still so pronounced that the hand was *en griffe* and useless. There was no rotation of the radius, and flexion and extension were very limited. Within a month, however, there was marked improvement. Extension was obtained to 150 degrees; flexion to 90 degrees; rotation of the radius to 90 degrees, and supination was complete. The fingers, with the exception of the index-finger, could be fully flexed and extended, and the thumb opposed to all. The patient was able to arrange her hair and feed herself. Since then the improvement had been continuous, and at the present time there was full extension, flexion to 95 degrees, pronation to 90 degrees, full supination and full flexion, and extension of the wrist. The inability to fully extend the index-finger, which could be done with the wrist flexed, the inability to fully flex the elbow, and the limitation of pronation to 90 degrees were the disabilities that still existed. The patient can now

play on the piano, and carry her six-months-old baby with that arm.

Dr. Fisk said that in all cases of either fracture of the ulna or dislocation of the head of the radius, a careful examination should be made to determine the presence or absence of the other injury. Immediate reduction of the dislocation should be attempted; if this could not be accomplished, then either an immediate or a deferred operation must be decided on. Opinions differed as to the advisability of an immediate operation; some considered it best, others thought that no operation should be performed for two or three months. Perrin held the view that an immediate operation should not be performed on patients under the age of fifteen because of the possibility of the necessity of excision of the head of the radius, which was undesirable before full growth had been attained. Ashhurst contended that reduction should not be impossible in recent cases if the operation was properly performed, and therefore that excision of the head of the radius would not be necessary. The object of operating was to remove the torn capsule from in front of the capitellum of the humerus and from over the lesser sigmoid cavity of the ulna, and to suture the capsule around the neck of the radius. Old, irreducible cases, where the ulna had united, were usually treated by excising the head of the radius.

Dr. Fisk said that 140 cases of this combined injury had been recorded up to the present time. Five of these were operated on immediately, and 26 after an interval of several months.

UNILATERAL HYPERTROPHY OF THE ARM.

DR. ROBERT T. MORRIS showed a girl, nineteen years old, in whom at birth it was noticed that one arm was larger than the other. Since then it had been observed that the disparity in the size of the two upper extremities had gradually become more marked, and at the present time the right arm was about two and a half inches longer than the left and more than three inches greater in circumference, and it was still increasing in size. The enlargement apparently included the bones, soft tissues, and blood-vessels, and resembled an angiomatous condition.

DR. MOSCHCOWITZ said that while he had no suggestions to offer in regard to treatment, the condition in the case shown by Dr. Morris was one that had been described more or less frequently under the name of partial gigantism "Riesenwuchs," of

which the speaker said he presented an example before the Surgical Section of the New York Academy of Medicine a few years ago. In that case, one of a man's toes was affected, and on account of its gradual increase in size he said that it kept him poor buying new shoes. An examination showed that there was an enlargement of the entire right lower extremity and of the right abdomen.

Dr. Moschowitz said that this condition was congenital, the enlargement was of an angiomatous type, and involved both the bones and soft tissues. It had nothing in common, so far as he knew, with acromegaly or disease of the pituitary body. It was always congenital, and involved particularly the venous system.

Dr. GIBSON said he had seen this condition of unilateral hypertrophy limited to the great toe or to several toes.

Dr. FRANK S. MATHEWS, in connection with the case shown by Dr. Morris, said that about a year or two ago he saw a child who had had incisions about the shoulder in infancy for an epiphysitis. When Dr. Mathews saw the case, the affected arm was an inch or so shorter than its fellow, but about twice the circumference of the normal arm. The veins were very much enlarged, and there was a loud thrill over the vessels, and he suspected that he had to deal with an arteriovenous aneurism, while the arrest of growth was probably due to an osteomyelitis of the upper humerus. On operation he could find no connection between the artery and vein. The axillary artery was exposed and was found to be about two or three times normal size.

STRICTURE OF THE PYLORUS; POSTERIOR GASTRO-ENTEROSTOMY.

Dr. BENJAMIN T. TILTON presented a woman, 48 years old, who was admitted to the hospital three months ago suffering from severe epigastric pain and vomiting. Her history of stomach trouble dated back six years. The vomiting occurred about four hours after taking food, and the pain radiated toward each side. She had lost 25 pounds in weight.

Examination of the stomach contents revealed an excessive amount of free hydrochloric acid; no blood; no Boas-Oppler bacilli. The motility of the stomach was diminished, and its lower border reached to the umbilicus. The case was regarded as one of dilated stomach due probably to a benign stricture of the pylorus.

Operation showed a distinct thickening at the pylorus, a few regional glands in the greater and lesser omentum, and a very large stomach. A posterior no-loop gastro-enterostomy was done, with clamps. The enlarged glands showed a simple hyperplasia of the glandular elements. Since the operation the patient had gained about ten pounds and had had no recurrence of her digestive symptoms.

PYLORIC ADHESIONS.

DR. BENJAMIN T. TILTON presented the patient, a woman 33 years old, who for ten weeks prior to her admission to the hospital had suffered from vomiting following the ingestion of food. This was accompanied by epigastric pain radiating through to the back. She had lost about 30 pounds in weight. Treatment by her physician in the form of diet and medication had produced no effect upon the vomiting, which had become so constant after eating or drinking that she practically took nothing into her stomach. It was impossible to get a gastric analysis, as the test meal was immediately vomited.

During the patient's first week in the hospital an attempt was made to overcome the vomiting but without result, and as the patient was becoming very weak, an operation was advised. Upon exposure, the stomach appeared to be of normal size, and an examination of the gall-bladder showed nothing abnormal. Thin adhesions, however, were found extending from the gall-bladder to the pylorus, which were readily divided, without hemorrhage. As there was no obstruction at the pylorus, a gastro-enterostomy did not seem indicated.

With the operation, the vomiting ceased immediately, and it had not recurred since. The patient had regained her lost weight in the two months since she left the hospital. She was able to eat practically any kind of food and felt that she was entirely well.

DR. WILLY MEYER said that in operating on these cases of pyloric obstruction, the possibility of an early malignant condition should never be lost sight of. While the immediate examination of frozen sections was of value in establishing the diagnosis, he no longer placed implicit faith in the accuracy of such reports, and when he had to deal with an infiltrated and strictured pylorus which was at all suspicious of an early carcinoma, he favored a radical excision though the glands were reported

healthy. He recalled one of his cases where a failure to follow this rule led to subsequent regret, and where a patient who had been assured that he had been relieved of a benign obstruction of the pylorus by means of gastro-enterostomy returned two years later with an inoperable carcinoma. The speaker said he was now strongly in favor of resecting the strictured pylorus in every case, provided the patient's general condition permitted such radical work.

DR. MORRIS called attention to the fact that adhesions about the pylorus and gall-bladder, such as Dr. Tilton encountered in his case, often showed the presence of the colon bacillus. These belonged to the group that had been described by the speaker as cases of "cobwebs in the attic."

GIANT MUCOCELE OF THE APPENDIX; RESECTION OF CÆCUM; ILEOCOLOSTOMY.

DR. WILLY MEYER presented a man, 42 years old, who for the past three years had shown all the evidence, clinically, of a chronic appendicitis. Examination showed a tumor formation in the region of the cæcum which was suggestive of either tubercular or malignant disease. The tumor was slightly tender on pressure, and the patient also complained of pain when the bladder was filled or emptied, indicating the presence of adhesions. He gave a history of having had frequent attacks of mild intestinal obstruction, with pain and vomiting.

Operation, December 28, 1911: Dr. Meyer made an incision alongside the rectus, coming down on a mass which was adherent to the bladder and iliac fossa. After double ligation and division it was seen that this mass had the shape of the appendix, which could not be found. The cæcum was much infiltrated. The lower end of the ileum with cæcum and half of the ascending colon were excised and both ends closed. An ileocolostomy was then done with needle and thread, making an anastomosis between the ileum and the first half of the transverse colon, as safe access to the ascending colon was impossible.

The abdomen was closed, and after a stormy convalescence the patient recovered. Pathologically, the specimen proved to be a giant mucocoele of the appendix, filled with gelatinous mucus. The specimens were presented.

DR. BURTON J. LEE said he recently saw a very excellent specimen of a mucocoele of the appendix, a case of Dr. Kenyon's.

It was not quite as large as the one shown by Dr. Meyer, but very distinct, without any opening into the bowel. The specimen was examined by Dr. James Ewing, and there was some question in his mind as to whether it really was a cyst of the appendix. It was filled with material similar to that found in Dr. Meyer's case.

DR. MATHEWS said that about ten years ago, while doing pathological work at the Woman's Hospital, he saw a specimen of this type, although not nearly so large. It was about the shape of an Indian club and was filled with material similar to this.

DR. MOSCHCOWITZ recalled a case where he had operated on an appendix much smaller than the one shown by Dr. Meyer, where he found that the appendix had perforated and that a large quantity of this gelatinous material had escaped, almost filling the abdominal cavity. The speaker said he thought that this material was almost of a malignant nature, and as some of it was necessarily left behind in the abdominal cavity, recurrences were to be expected.

RESECTION OF THE STOMACH FOR BENIGN PYLORIC STENOSIS.

DR. WILLY MEYER presented the patient, a man 36 years old, who was admitted to the German Hospital on May 23, 1912.

The history he gave was that about seven years ago he began to suffer from discomfort and often pain, with belching of gas, after meals. The pain was confined to the upper abdomen. These symptoms continued for about two years. Five years ago he had a sudden and severe hemorrhage from the stomach, and after recovering from the effects of this loss of blood he was free from stomach symptoms for two years. Then he again began to suffer from gastric pain, occurring two or three hours after meals, together with loss of appetite. About three weeks before coming to the hospital he began to vomit, the attacks of vomiting usually coming on two or three hours after meals. The patient stated he often vomited more than he had eaten at the previous meal, and that the vomitus at times contained food taken on the preceding day; there was no further history of hæmatemesis. He denied lues.

The patient, on admission, was emaciated and anæmic. There was no jaundice. The heart and lungs were negative. The abdomen was flat and tense; no tenderness; no abnormal masses could

be felt. Upon lavage of the stomach, fully a quart of fluid containing undigested food, large particles of bread, etc., was evacuated, and after ten pints of fluid were introduced, the washings failed to return clear.

The case was regarded as one of pyloric stenosis, probably benign, and on June 6, 1912, Dr. Meyer exposed the stomach through a median incision, coming down upon a hard, nodular mass at the end of the first portion of the duodenum, and firmly adherent to the head of the pancreas. Owing to the inaccessibility of this mass, a transverse incision was made across the right rectus. The tumor mass was then freed from the surrounding structures. Now Hueltl's surgical wire stitching instrument (large clamp) was placed at the gastric side of the mass, and a similar smaller clamp placed distally, *i.e.*, on the jejunal side. The metal staples in the stomach held well, but a few of the duodenal stump tore through, when the latter was handled. A continuous silk suture inverted the stump in the stomach and a double one that of the duodenum.

An opening was then made in the mesocolon, a portion of the stomach rest drawn through this orifice, the stomach united to the margin of the wound in the mesocolon, and a posterior gastro-enterostomy made between it and the duodenum with the button. There was hardly space on the stomach side to insert the button. The wound was then closed, and the patient made an uninterrupted recovery. The pathologist (Dr. James Ewing) reported that the stricture was of benign character.

The speaker said that he was much indebted for the exhaustive report on the specimen by Dr. Ewing, who had volunteered to examine all specimens of pyloric resection for the surgeons, who had joined the committee for a collective investigation of ulcer of the stomach, that had recently been formed here in conjunction with the original one in Germany. In this case it seemed that a primary disease of the arterial walls had caused the development of the ulcer.

DR. MEYER, in reply to a question, said that while the wire-stitching instrument, which he had used in this case, and which he had demonstrated at one of the previous meetings of the Society, saved a certain amount of time, its chief advantages were that it left the line of suture absolutely dry and aseptic. In stomach surgery its employment was not of much importance, but in suture work about the cæcum or colon where the patients

were much reduced, its simplicity and the dry, aseptic suture line it gave might well be of value. Objections to the use of the instrument were that it was expensive, the cleaning and recharging somewhat complicated, and that any damage to it could probably not be repaired on this side of the Atlantic. He emphasized that he favored the use of needle and thread in our daily routine work on stomach and intestines.

DIFFUSE DILATATION OF THE THORACIC AORTA;
EXPLORATORY THORACOTOMY.

DR. WILLY MEYER presented a man, 43 years old, who was admitted to the German Hospital on May 15, 1912. He gave a history of gonorrhoea and chancre over 20 years ago, and pneumonia four years ago. His wife had had eight children, four of whom were alive and well; three had died at birth from convulsions. No miscarriages.

About a year ago the patient began to have pain in the upper portion of the left abdomen and the lower left chest. This gradually became more severe, so that he had to give up his work about four months ago. It was worse after eating. There was no history of vomiting. For several months he had suffered from cough, with free expectoration. His sputum had been examined by the Department of Health on four different occasions, with negative results. There was no history of night sweats; no blood. The patient complained of some difficulty in swallowing; he occasionally belched gas and had sour eructations. He was constipated and had lost about 25 pounds in weight since January.

Upon admission, the patient was found to be poorly nourished. There was dilatation of the veins on the left side of the neck. The man's breathing was chiefly abdominal in character, and even on deep inspiration the chest moved but slightly. There was no asymmetry nor deformity of the chest. The breathing was vesicular in quality, and the sounds were markedly diminished over the entire left chest, both anteriorly and posteriorly. There was no alteration in the voice sounds. The cardiac dullness extended one inch to the left of the left midclavicular line, in the fifth interspace. There was a diffuse precordial pulsation seen and felt, but no definite apex impulse. There was a soft, blowing systolic murmur heard in the mitral area and in the second left interspace; not transmitted to the neck. There was an occasional intermittence; otherwise the heart sounds were


regular in force and rhythm. The chest was barrel-shaped; the lips and finger-nail beds slightly cyanotic. The abdomen showed nothing abnormal. The radial pulse was somewhat weaker on left side, but regular; there was increased tension; no radial thickening. X-ray examination showed a shadow in the left part of the chest, corresponding to a diffuse dilatation of the entire thoracic aorta. In view of the missing typical clinical symptoms an intrathoracic tumor could not be excluded.

Operation, June 20, 1912: Exploratory thoracotomy under differential pressure. An incision, eight inches long, was made between the seventh and eighth ribs, commencing near the spinal column. After dividing the muscular tissue down to the pleura, the lung could be seen, freely movable, through the pleura. After incision of the pleura and upon drawing the two ribs apart and pushing the lung to one side, a diffuse dilatation of the thoracic aorta was seen. The dilatation reached downward to about one inch above the diaphragm. The lung was adherent to the aneurism and riding on it anteriorly in the upper portion of the pleural cavity. The thorax was then closed in typical fashion. Patient made an uninterrupted recovery. He was out of bed on the fifth day after the operation with primary union of the thoracotomy wound. To-day patient claims to be stronger and better than before the operation.

DR. WILLIAM C. LUSK said that he had performed the Moore-Corradi operation on at least two cases of fusiform aneurism of the aortic arch with resulting relief to the distressing symptoms, the X-rays of the results demonstrating the loops of wire lying just within the limits of the aneurismal shadows. The technic which he employed was to use the No. 29 size of the resilient gold platinum silver copper "clasp" alloy wire, shaped in loops of a diameter greater than that of the X-ray shadow of the aneurism, the entering extremity of the wire being spiroform, which he introduced through the insulated gold needle into the aneurismal cavity after the manner of uncoiling a rope, by which manœuvre twists were carried in with the wire as it was fed in, causing the loops to re-form within the aneurism, which, from their large size, expanded to the limit allowed by the confines of the aneurism, thus taking a peripheral arrangement within the sac. The wire was in this way so placed that the electrical current passing through it could traumatize the intima. A current of 100 milliamperes, 50 milliamperes, 40 milliamperes, 30 milliamperes, each for 15 minutes, was passed, which in the case of wiring a dog's

aorta would both traumatize the intima at the sites of contact of the wire and cause a deposit of fibrin along the wire, which at the sites of trauma would become adherent during the passage of the electrical current, and, subsequently undergoing organization, would produce thickenings in the arterial wall. Laminated fibrin in aneurisms seemed to be laid down only in those localities where the blood stream was sufficiently slowed. No complications had supervened as a result of using this technic.

A SIMPLE APPARATUS FOR INSUFFLATION ANÆSTHESIA.

DR. JOHN ROGERS demonstrated this apparatus, which consisted of an ordinary foot bellows and tube to which was attached a Y glass tube with one arm of the Y leading into a six-ounce bottle containing sterilized cotton for filtering the air, and thence into an arm of another Y tube and so to the silk elastic catheter for introduction into the trachea. A  tube carrying a "Ty-cos" sphygmomanometer was joined to the proximal end of the catheter to show the air pressure. The opposite arm of the first Y tube leads to another six ounce filter bottle, containing sterilized cotton, and from this into and out of the top of another similar sized bottle containing ether and thence through a third empty bottle to catch any condensation of the vapor and from the third bottle into the unoccupied arm of the second Y tube, and so to the tracheal catheter. A stop cock on each arm of the first Y tube regulates the amount of air which thus passes in two directions, No. 1 through the bottle containing only cotton and No. 2 through a series of three bottles, one of which supplies the ether vapor. Experience with three cases of operations upon structures causing difficulty with respiration after preliminary trial on animals showed that this "home made" and inexpensive apparatus is very satisfactory. The Ty-cos sphygmomanometer could be replaced by any other of the common instruments for measuring blood-pressure. It is only with difficulty that the air pressure can be raised above the 20 mm. of mercury which is known to be the safe limit. Dr. Rogers introduces the catheter through the larynx by touch alone like an intubation tube. The four bottles, one of which carries filtered air only and the other three filtered ether vapor, are immersed when in use in a basin of water at 105° F. The two stop cocks are left open so that an equal amount of pure warmed air and of pure warmed air carrying ether vapor enters the patient's trachea.

*Stated Meeting, Held at the New York Academy of Medicine,
November 27, 1912.*

The President, DR. CHARLES L. GIBSON, in the Chair.

EXTENSIVE OSTEOMYELITIS.

DR. HOWARD D. COLLINS presented a girl, twelve years old, who was admitted to the hospital on June 11, 1911, with the history that for three days she had suffered from a high fever, with pain in the right forearm and right thigh. On admission, the right thigh was tender, and the right wrist presented the appearance of an acute articular rheumatism. On the following day there was a small point of fluctuation on the dorsal surface of the wrist. An incision showed an infiltration of pus throughout the muscle planes of the forearm, with a tiny perforation through the periosteum at the lower end of the radius, from which pus was oozing. Upon incising the periosteum, the entire radius was found to be destroyed subperiosteally. A month later an incision was made over the right thigh and necrosed bone found in the lower part of the femur, with staphylococcus infection. The patient's convalescence was very protracted, and during the 18 months that she remained in the hospital many secondary operations were necessary. She finally recovered entirely, and the X-ray plates showed regeneration of bone in various stages of formation in the radial periosteum.

DR. CHARLES N. DOWD said he could recall several cases of very extensive osteomyelitis in which subsequent regrowth of the bone took place. The epiphysis is usually preserved. In the case shown by Dr. Collins, he did not feel at all convinced that the epiphysis had been destroyed and hence would not be surprised to see a re-formation of the bone. The speaker said he was in favor of leaving a longitudinal section of the bone in these cases, as Dr. Collins had done, rather than to remove the entire shaft, as had been advocated by some. Such a strip of bone gives a support to the limb, and preserves the shape of the bone; the radiograms indicate well-formed new bone at the end of a year, and it takes as long as this when the entire shaft has been removed.

COMPOSITE ODONTOME.

DR. FRANK S. MATHEWS presented a boy, eleven years old, upon whom he had operated two years ago for a tumor of the mandible, near the angle. An incision was made into the gum

over the tumor, through which the latter was removed with ease. It was a stony hard growth, lying practically free in the jaw in a cavity formed by the thinning out of the bone around the tumor and displacing the normal tooth follicles. The tumor (Fig. 1) was covered by a thin membrane which was reflected from the base of the growth and lined the jaw cavity, at the bottom of which the inferior dental nerve lay exposed.

The epithelial elements of the tooth follicles, Dr. Mathews said, might give rise to (a) dentigerous cysts, (b) benign multicystic tumors, and (c) adamantinomata, which were locally destructive but otherwise of low grade malignancy, since they rarely gave rise to metastases. The dentine organ could also form the origin of tumors. In the growth presented, all the tooth elements were present, hence, it was a compound odontome. The mass of tumor was composed of dentine.

MYELOMA OR GIANT-CELLED TUMOR OF THE TIBIA.

DR. MATHEWS presented a young woman, 24 years old, who was admitted to the St. Francis Hospital in September, 1911. She had had pain in the left knee for six months. This had been pronounced a tuberculosis of the knee at one of the hospitals in this city, and a resection had been urged. The limb had been in a plaster splint for some months.

Examination showed an unusually healthy appearing girl—an unlikely subject for tuberculosis. From immobilization of the limb the thigh and leg muscles had become atrophied, but the knee measurements were the same on both sides. There was stiffness of the knee, but no spasm, and the joint contained no fluid. The Von Pirquet test was negative. The X-ray (Fig. 2) showed a light area in the outer tuberosity of the tibia, but the lateral view showed that this area was half an inch from the anterior surface of the bone. The growth had nowhere expanded the bone.

The location of the disease as well as the X-ray appearances suggested the diagnosis of a myeloma or giant-celled tumor, usually called sarcoma. At operation, a longitudinal incision was made over the tuberosity, and after cutting away a half inch of normal bone the tumor was reached. An Esmarch bandage had been applied, so that the macroscopic character of the tumor could be carefully studied. With the curette, a mass of granulation-like, plum-colored material was removed

FIG. 1.



Composite odontome.

FIG. 2.



Myeloma or giant-celled tumor of tibia.

from the cavity whose dimensions were an inch by an inch and a half. The joint cavity was invaded for a circular area about three-fourths of an inch in diameter. The walls of the cavity were vigorously scraped and then swabbed with a strong bichloride solution. An effort was made to diminish the size of the cavity by cutting away its bony margins and forcing the periosteum deeper down, after the Neuber method, and the wound was then packed with sterile gauze.

Great care was taken to preserve asepsis, because of the open communication with the knee-joint. Synovial fluid drained out for some weeks. The wound remained clean and soon healed down to a small sinus, which required a year to close. The patient now had a useful limb as far as bearing her weight was concerned, but the knee was stiff. There was no suggestion of recurrence.

DR. MATHEWS said the lesion in this case was a vascular and cellular tumor composed of round- and polyhedral-cells, with occasional giant-cells, although the latter were much less conspicuous than in the usual giant-celled tumor of bone. The cellular character and the scarcity of giant-cells might make one fear that the tumor was less benign than the typical giant-celled tumors. In another case reported by the speaker ("Myeloma of the Long Bones," *ANNALS OF SURGERY*, Sept., 1910), which was treated by curettage, a microphotograph of the tumor was shown in which giant-cells were very scarce, yet the patient had remained well for nine years. In the case shown at this meeting 15 months had elapsed since the operation, and Dr. Mathews said he had little doubt that a permanent cure had been effected. He had long felt that these tumors should not be called sarcomata, because they were benign. Bloodgood had suggested the name giant-celled tumor. The speaker's only objection to this name was based on his experience in the two cases mentioned, where tumors which seemed clinically to belong to this group had been conspicuously poor in giant-cells. In his paper on the subject above mentioned, he had followed Sutton and Adami in calling them "myelomas," a term that could be criticized because it suggested an origin in narrow cells, whereas it was more likely that they were produced by the osteogenetic elements of bone. Their foreign character and the wisdom of conservative treatment in dealing with them had been quite strongly evidenced in recent years.

CARCINOMA OF THE AXILLARY BREAST TISSUE.

DR. FRANK S. MATHEWS presented a tumor which was removed from a woman, 65 years old, who had noticed a mass in the floor of the right axilla for six months. She had no children, and the breast on the right side presented no abnormalities. Examination revealed a mass the size of a hickory-nut, slightly adherent to the skin of the centre of the axillary floor. It did not seem to be connected with the deeper tissues, and under the impression that it was a sebaceous cyst or fibroma it was removed, together with the overlying skin and the surrounding axillary fat. Microscopically, it proved to be an adenocarcinoma (Fig. 3), with much dense stroma, simulating this type of tumor as it occurred in the mammary gland. An alternative possibility would be that it had its origin in the sebaceous gland, but if such were the case one would expect the tumor to be more intimately connected with the skin than was actually the case.

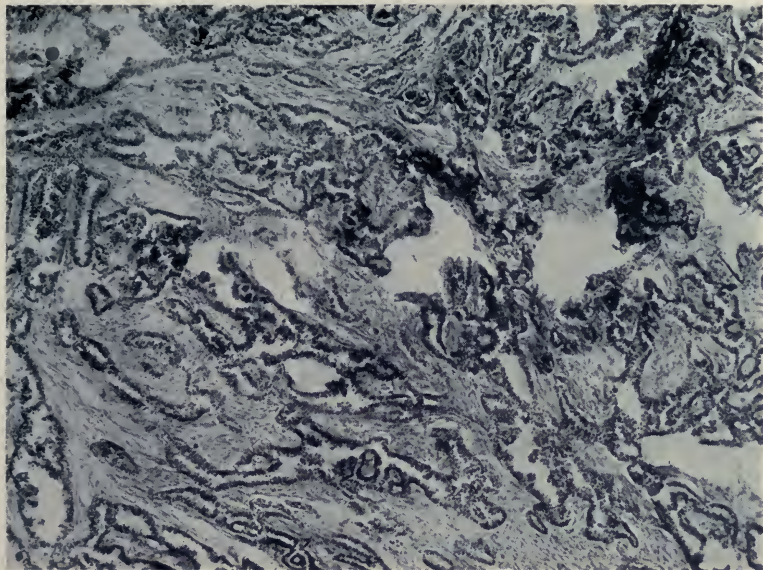
CARCINOMA OF THE AXILLA.

DR. MATHEWS presented a specimen removed from a man, 47 years old, who presented himself with an attack of jaundice which at the time was diminishing, and which was his fourth attack of what seemed to be gall-stone obstruction. The first two attacks were characterized by pain alone, the next by jaundice, and the present one by jaundice, chills, and fever. The jaundice was not extreme, and there was only slight tenderness in the right hypochondrium.

At operation, an incision was made permitting of thorough exploration: the gall-bladder was found to be moderately distended, the liver slightly cirrhotic, and the pancreas hard and small, but nothing suggested an impacted stone. Concluding that the case was one of pancreatitis, or that a stone had slipped into the intestine, as the clearing up of the jaundice and the disappearance of the chills would indicate, the gall-bladder was drained and inverted by two purse-string sutures around a small tube.

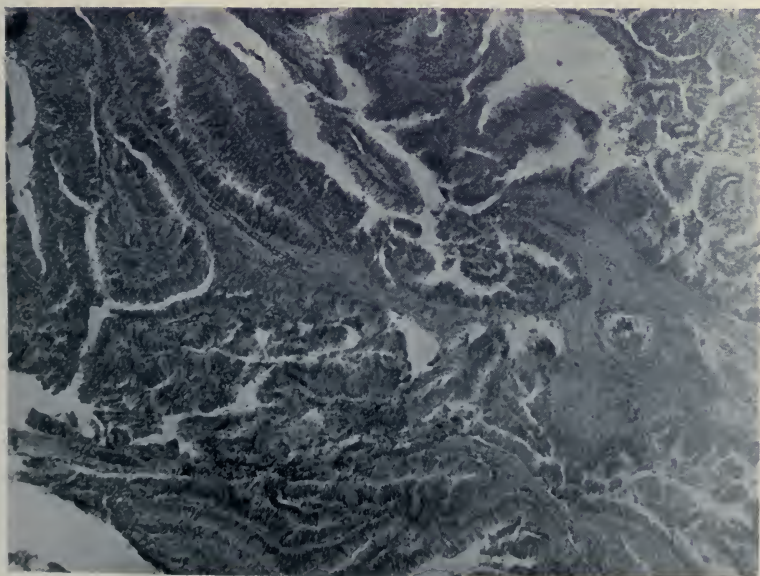
After this operation the jaundice disappeared, but the stools remained slate-colored and all the bile drained out through the gall-bladder sinus. It was obvious that a more definite obstruction than that of pancreatitis existed, and a second operation, with the possibility of a cholecystenterostomy, was ad-

FIG. 3.



Adenocarcinoma of axilla.

FIG. 4.



Carcinoma of the papilla of Vater.

vised, but to this the patient did not consent until two months later. An incision was then made to the inner side of the gall-bladder sinus, but the gall-bladder was not disturbed. The recent adhesions were readily separated and the ducts explored. A mass the size of a hazel-nut was felt and was thought to be a stone impacted in the duct. Determining to remove it from behind the duodenum, the latter was mobilized by an incision through its peritoneum on the outer side, and the duodenum brought up into the wound. The mass was then felt to be inside of the duodenum. It was exposed through an incision in the axis of the gut, and proved to be a papillary growth about the orifice of the gall- and pancreatic ducts, measuring between half and three-quarters of an inch in diameter (Fig. 4). Upon cutting it away, together with an area of normal mucous membrane, there was a rush of bile into the intestine. The openings into the duodenum and the abdominal wall were then closed, the gall-bladder sinus being left as a safety-valve. Small quantities of bile leaked through it at intervals for two months.

In this case, Dr. Mathews said, it would have been easy to establish drainage by a cholecystenterostomy, using either suture or the Murphy button, had it appeared wise. The dilation of the gall-bladder was sufficient to bring it in contact with either colon or duodenum. Dr. Pumpelly of Macon, Ga., to whom he was indebted for the case, wrote three months after the operation that the patient was apparently well and had resumed his work. Microscopically, the tumor was a papillocarcinoma.

Dr. Mathews said that in the November, 1912, issue of the *ANNALS OF SURGERY*, Upcott, of Hull, England, presented cases of his own and abstracts of those in the literature. Those who were interested in this subject were referred to this article for an excellent account of the clinical side of these cases, as well as the prognosis based on the different methods of treatment.

SEPARATION OF THE UPPER EPIPHYSIS OF THE HUMERUS IN A CHILD.

DR. WILLIAM A. DOWNES presented a child, four years old, that was admitted to the New York Hospital on September 18, 1912, with the history of having been knocked down by an automobile a few hours before. Examination showed an injury to the right shoulder, which the X-ray proved to be a separation of the upper epiphysis of the humerus. The case was presented

as illustrating a perfect result obtained by a very simple method—reduction by downward traction and securing the upper arm to the body by two straps of adhesive plaster, one at the elbow and the other midway from elbow to shoulder. At this time, two months after the injury, the two shoulders are the same in appearance and the child has perfect use of the injured arm.

FRACTURE OF THE SURGICAL NECK OF THE HUMERUS IN A CHILD: OPEN OPERATION.

DR. DOWNES presented a child, four years old, who on June 1, 1912, fell a distance of ten feet into an areaway, injuring the left shoulder. Five days later, when the child was admitted to St. Francis' Hospital, an examination disclosed a fracture through the surgical neck of the left humerus (Fig. 5). Efforts to reduce and hold the fracture failed, and two days after admission the child developed a tonsillitis and bronchopneumonia which prevented further efforts at reduction until June 25. On that date, under anæsthesia, an unsuccessful attempt was again made to reduce the fracture. An open operation was then done and an oblique fracture found, and in order to maintain reduction a nail was driven in the line of the head and shaft through the coraco-acromial ligament (Fig. 6). Dressing was applied with arm abducted 45 degrees. When the nail was removed, three weeks later, the fragments had firmly united. Now the child has normal motion in the joint in every direction, with the exception of very slight limitation when extreme elevation is attempted.

TORTICOLLIS, ILLUSTRATING TREATMENT.

DR. ROYAL WHITMAN presented a girl, 17 years of age, who had been treated for severe torticollis. Dr. Whitman said the essentials of the treatment were complete division of the contracted tissues, forcible stretching, and fixation in a plaster support in the over-corrected attitude for several weeks, followed, if possible, by methodical stretching and gymnastic exercises. The failure of the primary over-correction and of the after-treatment were the chief causes of unsatisfactory results.

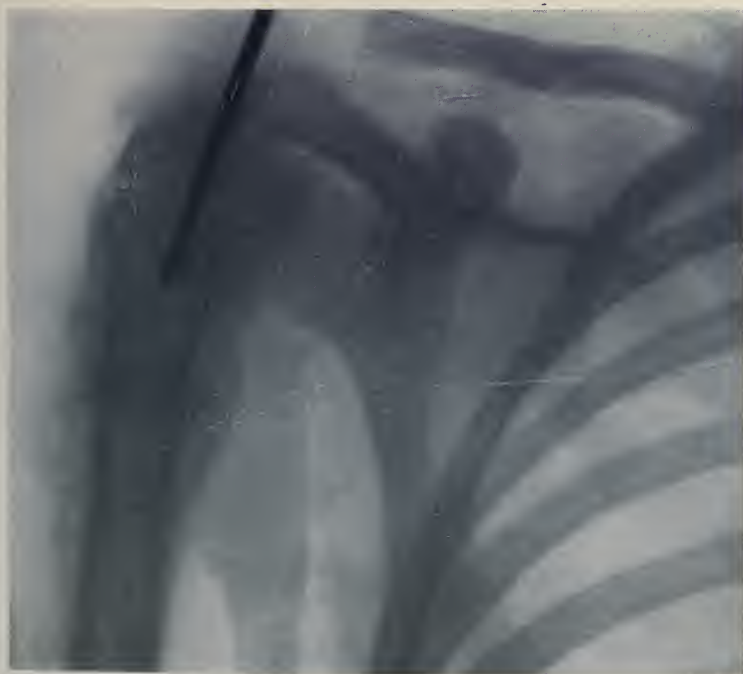
DR. CHARLES L. GIBSON said it would be interesting to note the final outcome of this case. Any form of treatment usually was followed by immediate improvement, but recurrences were the rule. Personally, he was inclined to believe that complete excision of the sternomastoid was indicated in very aggravated cases.

FIG. 5.

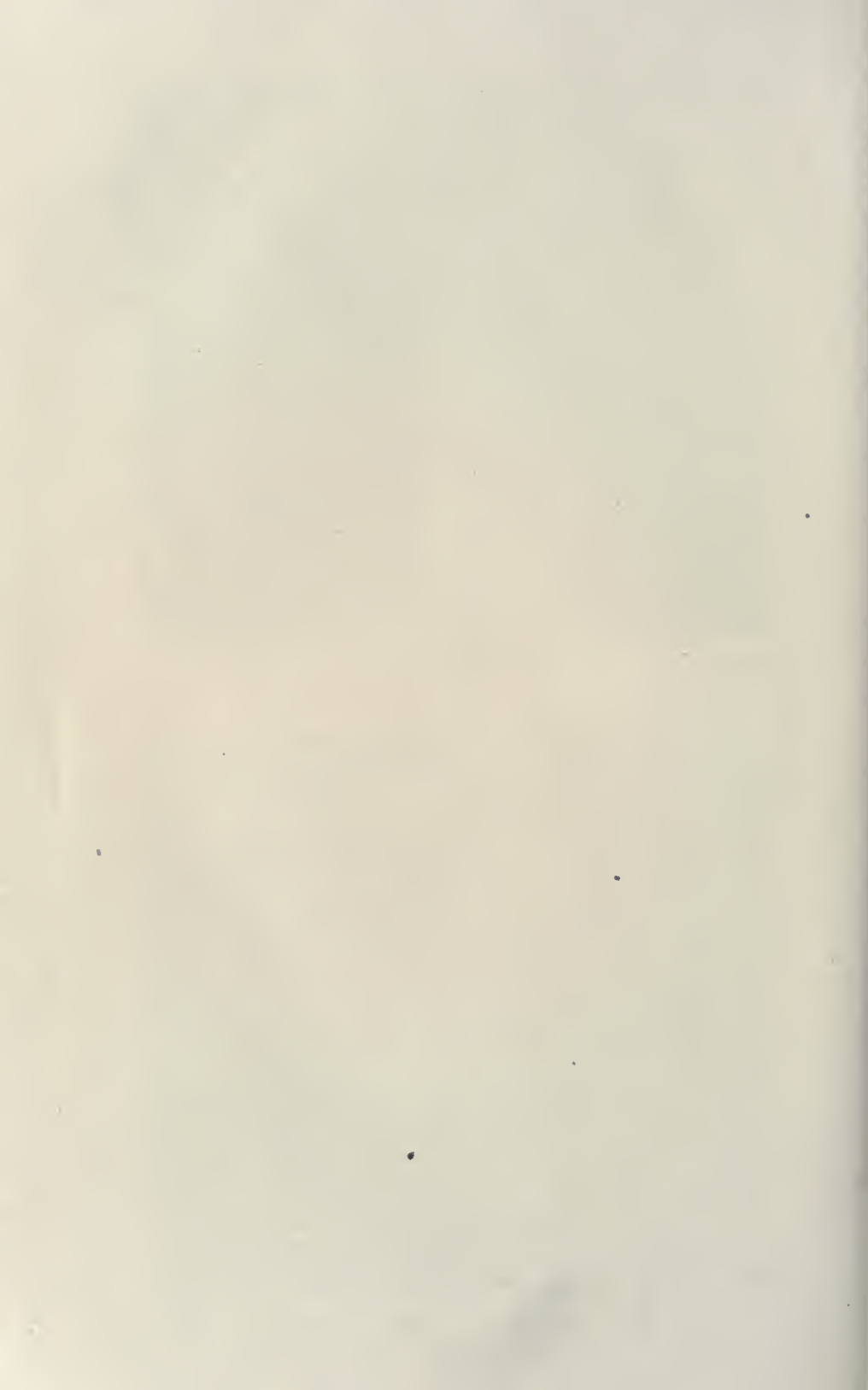


Fracture of the surgical neck of the humerus.

FIG. 6.



Fracture shown in Fig. 5, with nail driven through head into shaft to maintain fragments in position.



DR. WHITMAN, in reply to the statement of Dr. Gibson that a recent case was not convincing, said, that a deformity of long standing could not be cured by any operation. Division of the contracted tissues enabled one to over-correct the deformity. This over-correction should be retained for a sufficient time and should be supplemented, if possible, by methodical stretching and by exercises, for unless the deformity habit were overcome, recurrence in some degree at least might be anticipated.

The Mikulicz operation represented apparently another point of view, namely, that torticollis might be cured by an operation, if it were sufficiently radical. As the muscle was but one of the factors of deformity, its removal was, he thought, illogical, and it had the further disadvantage of leaving an unsightly scar.

DR. F. KAMMERER said that in a very aggravated case of torticollis in an adult which he had observed last winter, simple division and appropriate after-treatment had been followed by a return of the contraction in three or four weeks. He then made a very complete extirpation of the sternomastoid muscle and the surrounding cicatricial tissue, which ultimately gave a much better result than mere division. The speaker was willing to admit that careful mechanical treatment after operation might improve the result after simple division.

REMOVAL OF THE SEMILUNAR CARTILAGES FROM BOTH KNEES.

DR. WHITMAN presented a woman, 22 years of age, from whom he had recently removed the internal semilunar cartilage from both knees for the relief of discomfort and disability of several years' duration. The speaker said he favored early operation in these cases, as a displaced cartilage was of no service, and rather a source of injury to the joint.

CHRONIC BILATERAL FIBROID BURSITIS.

DR. W. S. SCHLEY presented a mulatto, 38 years old, who had a firm, somewhat lobulated, movable tumor, at present one and three-quarters by one and a half by one inch in dimensions, on either forearm, just *below* the olecranon. These tumors were first noticed about four and a half years ago. They were absolutely symmetrical as regarded position, size and touch. Their growth had been gradual over a period of three and a half years, and the patient stated that during the past year they

had not increased in size. Prior to the development of these tumors the patient had worked as a sand-hog in caisson excavation, which necessitated awkward positions in which the elbows and forearms usually bore the brunt of the pressure. At times there was soreness over the olecranon and upper ulna, but this was never sufficiently severe to cause him to stop work. He gave no history of a simple bursitis or hygroma at the time that he was working. These tumors were below the true olecranon bursæ and were situated in the subcutaneous tissue over the upper part of the ulna. The possibilities seemed to be that they were fibrous tumors from connective-tissue irritation or fibroid changes in bursæ.

Actual tumor formation in bursæ was of rare occurrence, the more common form of bursal trouble, chronic bursitis, leading to thickening or even calcification of the sac, with occasionally spontaneous hemorrhages with organized fibrin contents, etc. As regarded new growths, Delfino, in 1905, found but 31 cases in the literature, chiefly myxoma and sarcoma. Duret actually found five bursæ in one person simultaneously the seat of endothelioma. In the case he had shown, Dr. Schley said, we probably had a true fibrous new growth. The patient gave a syphilitic history, but the tumors were in no way characteristic of that infection.

BLOOD INJECTION FOR UNUNITED FRACTURE.

DR. H. H. M. LYLE presented a young man, who was admitted to St. Luke's Hospital seventeen and a half weeks ago with a fracture of the tibia and fibula of the right leg. The fractures, which were at the junction of the middle and lower thirds, were treated in the routine manner, the fragments being placed in good position, as shown by the X-ray. Three and a half months later there was no attempt at union, and the X-ray showed a typical pseudo-arthritis. Bier's injections of blood were given, and at the completion of the eighth injection there was firm ankylosis. The nature of this union was clearly shown by the X-ray. Twenty to thirty cubic centimetres of the patient's blood were taken from the median basilic vein and injected between and around the bones. These injections were given every six days, and signs of commencing union were apparent after the third injection.

Dr. Lyle said he had found it difficult to carry out the

technic as described by Bier, on account of the rapidity with which the blood clotted. This called for very rapid work, which in turn interfered with the thoroughness of the procedure. To overcome this drawback he drew up some warm sterile albolene through the needle into the syringe and then expressed it, leaving a fine film of albolene covering the needle and syringe. This film prevented the clotting in the syringe and needle, and allowed a careful, accurate, and thorough injection of the blood around and between the fractured ends. He considered this small detail a great aid in carrying out this valuable method of treatment.

THE WIRING OF THORACIC ANEURISM.

DR. WILLIAM C. LUSK read a paper with the above title. In connection with his paper, Dr. Lusk showed four patients who had been successfully treated by this method. Also two specimens, showing the wired thoracic aneurism. He also showed a number of radiographic illustrations.

DR. WILLY MEYER said it was evident that surgery had made a great step forward in the treatment of these practically hopeless cases of thoracic aneurism by the Moore-Corradi method, and its development by Dr. Lusk. The speaker said that some twenty-five years ago he had seen Dr. F. Lange at the German Hospital wire an aneurism of the descending abdominal aorta, with very little resulting improvement in the patient's condition. That operation was done in a more or less experimental way. Since then the procedure had been placed on a more scientific basis, and we now knew that it was not only the wiring but the subsequent electrolysis that produced the beneficial effects. He recalled the case of a physician who was not long ago operated on by this method at the Johns Hopkins Hospital, and who was so much improved thereby that he had since been able to resume his practice. The splendid results in the cases presented by Dr. Lusk spoke for themselves.

Dr. Meyer said that recently, at the German Hospital, he operated on a patient who was suffering from what seemed to be a fusiform aneurism of the ascending aorta. The man was a hopeless invalid, suffering great pain, and at times expectorating blood. Dr. Lusk was present at the operation, and the technic he had described was carried out minutely. After properly coiling the wiring, previous to the operation, so that it could be readily uncoiled—and this required a great deal of

patience and labor—the needle was introduced into the aneurismal sac under local anæsthesia, and then 31 feet of the wire was fed into the sac without any difficulty and without the least resistance. Through this the electric current, carefully regulated, was then passed. Since the operation, the patient was apparently greatly improved. He had less pain, he slept better, and he suffered less from cough.

MULTIPLE RUPTURE OF THE SMALL INTESTINE AND MESENTERY.

DR. BURTON J. LEE presented a specimen, the history of which was that a man who was working in a marble-yard was felled by a slab of stone which fell from overhead, striking him on the head and knocking him down. While in a prostrate position, several other slabs of marble fell on his body and crushed him. He was immediately brought to Bellevue Hospital by ambulance and admitted to the service of Dr. John A. Hartwell. Examination showed a scalp wound over the right eyebrow; no fracture of the skull. He was very pallid and dyspnœic. The organs of the chest were apparently uninjured. The abdomen moved only very slightly on inspiration, and showed some ecchymosis in the umbilical region. It was rather rigid on both sides, and exquisitely tender. No masses nor movable dulness could be made out. There was a compound fracture of the neck of the left radius, with slight venous oozing from a wound over the fracture. The pulse was somewhat irregular and of poor quality.

The case was regarded as one of probable rupture of the intestine, with internal bleeding, and in spite of the man's desperate condition an operation was deemed imperative, and this was done by Dr. Lee about 45 minutes after the receipt of the injury. A saline infusion, with adrenalin, was given during the course of the operation. The peritoneal cavity was found filled with fluid blood. Upon exploration, a rupture of the small intestine was found near the cæcal junction; then, after several feet of normal gut, three other intestinal ruptures and two large rents in the mesentery were encountered. Two resections, with end-to-end sutures, were rapidly completed and the rents in the mesentery closed. The operation occupied 55 minutes, and the patient died just as the abdominal wound was being closed.

In connection with this specimen, Dr. Lee said that had he

sacrificed the several feet of normal intestine between the two ruptured areas, some time would have been saved, as it would have necessitated but a single resection, and the man might possibly have survived. Time might also have been saved by leaving the injured intestine outside of the abdomen, merely clamping the ruptured portions of the mesentery, and at a later date doing the necessary resection.

INTERMITTENT HOUR-GLASS STOMACH.

DR. H. H. M. LYLE reported this case and showed a number of radiographic plates illustrating the same. The patient was a woman, 31 years old, who entered St. Luke's Hospital on September 15, 1912. For seven years she had suffered from indigestion and pain in the left side and back, and during the past four and a half years she had vomited every morning. This latter symptom was considered by a gynæcologist whom she had consulted as reflex in character, due to an adherent retroverted uterus. An operative correction of the displacement was advised and carried out, but no symptomatic relief was obtained. On the contrary, the vomiting had grown steadily worse.

On entering the hospital, the patient's condition was so pitiful that she was put to bed and kept under close observation for a week. The striking feature was the vomiting; this occurred every morning before breakfast, sometimes only once, sometimes several times. The vomitus was watery, meagre in amount, and contained neither blood nor food particles. Preceding or during the attacks she complained of a painful sensation of constriction in her stomach.

On examination, the abdomen showed an old laparotomy scar extending three and a half inches above the pubes. The abdomen was tender to the left of the mid-line, about one inch above the umbilicus. Dilatation of the stomach and colon gave negative results. A vaginal examination showed that the uterus was in good position. The blood count was normal; the Wassermann and tuberculin reactions were negative. No blood was found in the stools. An analysis of the stomach contents showed a slight increase in the total acidity, and it was noted that a portion of the test meal could not be recovered, although in one test performed late in the afternoon, practically the whole amount of the fluid was recovered.

A series of X-ray pictures of the abdomen were taken,

showing an apparently typical hour-glass contraction of the stomach. The contraction was at the junction of the lower and middle thirds. It was clear cut, and about equally indented on both curvatures. The lumen of the contraction appeared to be about the thickness of the index-finger. Both pouches were well defined, and five minutes after the ingestion of a bismuth meal the pyloric pouch was filled with bismuth and some bismuth had already escaped into the small intestine. Six hours and fifty minutes later the stomach was empty and all the bismuth was in the colon, showing that there was practically a hypermotility.

In view of the X-ray and clinical findings, the diagnosis of an hour-glass stomach was made and an operation was decided on. This revealed an apparently normal stomach. At the junction of the middle and lower thirds of the stomach there was a suggestion of muscular hypertrophy, but there was no contraction of the lumen. A careful and systematic search was made of the pylorus, duodenum, gall-bladder and ducts, the appendix, and the site of the previous pelvic operation, and no gross pathological lesions of any kind could be demonstrated. The portion of the stomach proximal to the supposed contraction was inverted and stretched, and the abdomen was then closed. Since the operation, the patient had not vomited: she had gained 25 pounds in weight, and to all intents and purposes was perfectly well.

Dr. Lyle called attention to the fact that the series of X-ray plates taken since the operation showed a perfectly normal stomach, and that with the operative and X-ray findings as a guide, the only diagnosis that could be made was that of an intermittent hour-glass stomach. This diagnosis, he thought, could have been made before the operation, based on the following points: The X-ray pictures should be taken on different days, at different times, and in different positions. The test for the capacity of the stomach should be taken at different times during the day and on different days. A careful study of the X-rays showed the regularity of the pouches, and the fact that the contraction involved both curvatures equally. (A well-marked ring-shaped contraction was not physiological.) We could also note the clear-cut outline of the contraction, the time in which the bismuth passed from one segment to the other, and the fact that the stomach, despite this contraction, emptied itself in six hours and fifty minutes.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held October 7, 1912.

DR. GWILYM G. DAVIS, President, in the Chair.

SPRAIN-FRACTURES.

DR. PENN G. SKILLERN, JR., presented skiagraphs of cases of sprain-fracture as follows:

CASE I.—*Sprain-fracture of coracoid process of scapula.* A football player, aged 20, fell upon his right shoulder, causing luxation at acromioclavicular joint. Skiagram (Fig. 1) showed a scale of bone torn off from the coracoid, probably from traction upon the coracoclavicular ligaments. Fractures of the coracoid process are rare, their line usually involving the base. The frequency of combination of this sprain-fracture with luxation at this point has not been established.

CASE II.—*Sprain-fracture of wrist.* This skiagram (Fig. 2) of an ordinary "sprained wrist" showed avulsion of a scale of bone from the dorsum of the carpus, probably from the os magnum. This scale was not palpable on account of the swelling, but there was distinct localized tenderness over it. A skiagram should be made of every "sprained wrist" and the treatment should be immobilization.

CASE III.—*Sprain-fracture of anterior superior spine of ilium.* Male, aged 16, during a foot race felt something snap in upper part of left thigh, but finished race (five yards). Pain aggravated by flexion of thigh. Skiagram (Fig. 3) showed avulsion of a shell of bone from the anterior superior spine and its immediate vicinity, evidently from action of the sartorius muscle.

CASE IV.—*Sprain-fracture of cuboid.* S. K., male, aged 23. Twisted left foot inward and heard something crack, immediately after which swelling appeared at external tarsometatarsal joint. No previous injury here. Examination showed swelling and ecchymosis between external malleolus and this joint, and defi-

nately localized tenderness at antero-external corner of cuboid, suggesting sprain-fracture of same. Skiagram (Fig. 4) showed chipping off of a sliver of bone from antero-external corner of cuboid, evidently from overstretching of the dorsal tarsometatarsal ligament at this site. Foot strapped in over-abduction with relief of pain.

CASE V.—*Fracture of adductor tubercle of femur.* Boiler-maker, aged 20, received a blow upon the lower part of the left thigh. There was localized tenderness just above internal condyle. Skiagram (Fig. 5) showed separation of adductor tubercle, and the tendon of the adductor magnus leads to it as a shadow.

CASE VI.—*Fracture of sustentaculum tali.* Male, aged 35, fell from a height of 10 feet, landing on feet. Skiagram (Fig. 6) showed an impaction of the sustentaculum into the body of the os calcis.

CASE VII.—*Fracture of clavicle, sternal end.* Male, aged 40, was struck by a heavy object upon the right clavicle. Examination revealed a dense and tender swelling over the clavicle near the sternum, which to inspection resembled a neoplasm and a luxation at the sternoclavicular joint. Skiagram (Fig. 7) revealed a line of fracture within an inch of the sternoclavicular joint. In the literature this fracture is very infrequently met with.

CASE VIII.—*Syphilis hereditaria tarda of femur.* Male, aged 22, farmer. Except for lesion in left thigh is robust and healthy. Three years previous to admission had what was diagnosed and treated as a fracture of the femur. For several years before that had had trouble with left femur, giving rise to a perceptible limp. Examination revealed marked bowing of left thigh, the point of greatest convexity being 13 cm. below the anterior superior iliac spine. Left thigh 6.5 cm. shorter than right. On palpation the upper part of the femur was of great uniform diameter, markedly roughened, but not tender. No inflammatory manifestations, no areas of softening, no sinuses. There was no history of tuberculosis, malignancy, or syphilis in the family. Diagnosis of late hereditary syphilis of femur made. Skiagram (Fig. 8) revealed marked increase in diameter of upper half of femur; obliteration of medullary cavity; alternating areas of osteoporosis and osteosclerosis; and the line of an incomplete fracture at the point of greatest convexity of the femur. Wassermann reaction positive (Ivy). Mercury and iodide treatment

FIG. 1.



Fracture of coracoid process scapula.

FIG. 2.



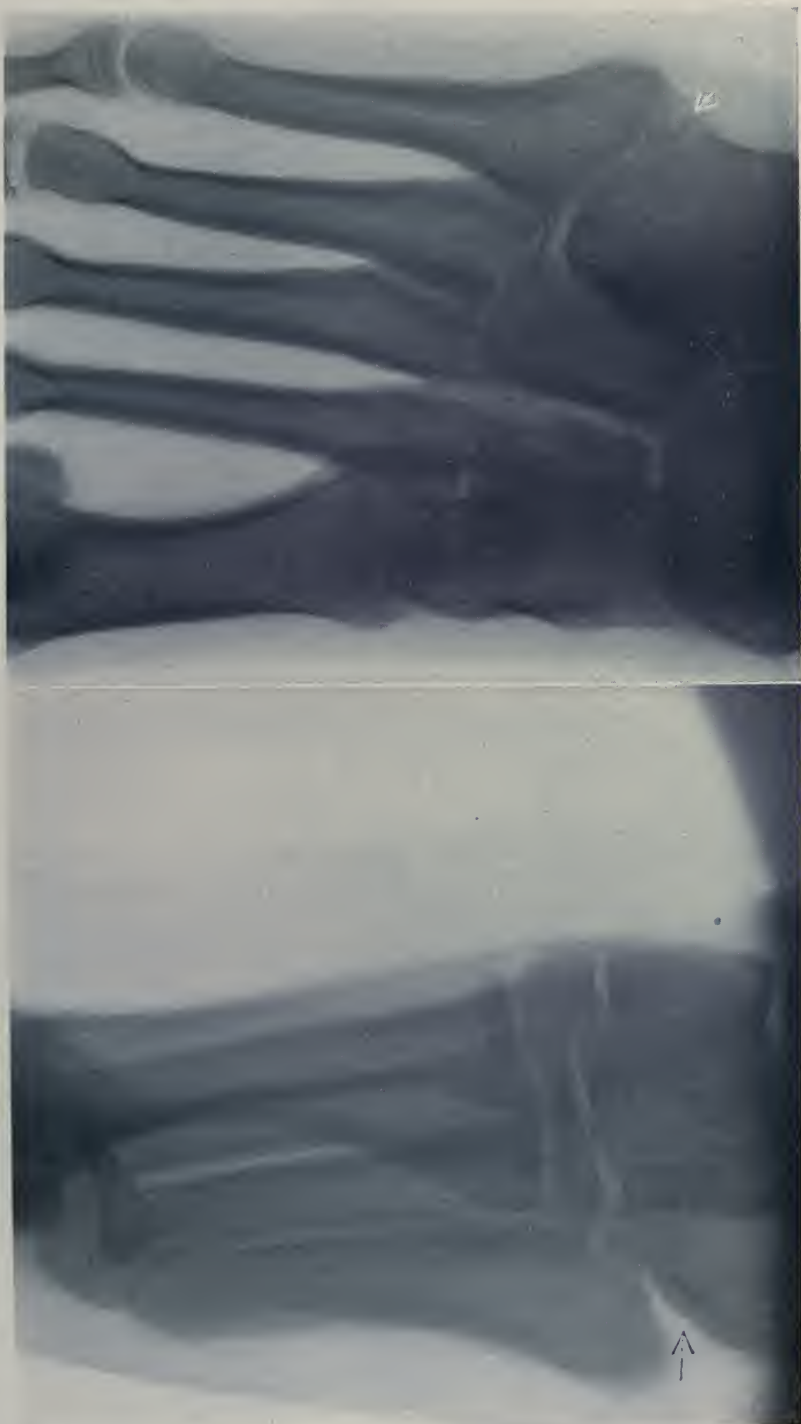
Sprain. Fracture of wrist.

FIG. 3.



Sprain. Fracture of anterior superior spine of ilium.

FIG. 4.



Sprain fracture of tarsal cuboid.

FIG. 5.



Separation of adductor tubercle of the femur.

FIG. 6.



Fracture of sustentaculum tali.

FIG. 7.



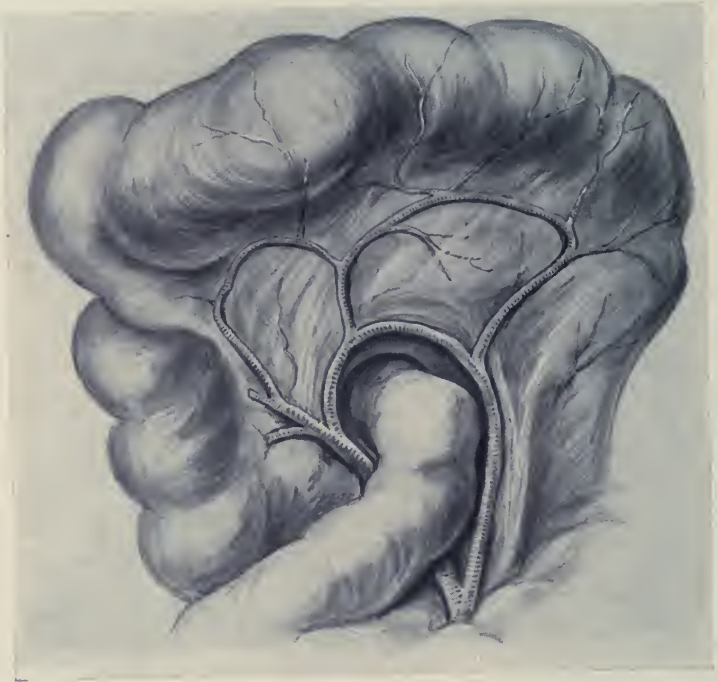
Fracture of internal end of clavicle.

FIG. 8.



Hereditary syphilis of femur.

FIG. 9.



Mesocolic fossa of extraordinary depth.

was instituted and an orthopædic splint adjusted by Dr. Willard so as to transfer weight supported by left lower limb from ground to pelvis as a base of support. After 8 months, while the patient had better use of and less inconvenience with the limb, yet skiagrams indicated but little change in the condition of the bone, and quite recently a dose of neo-salvarsan was administered.

CASE IX.—*Mesocolic fossa of extraordinary depth.* Found in a female body in the angle between the duodenojejunal flexure and mesocolon, this fossa measured 3.5 cm. in width, and 4 cm. in depth (Fig. 9). The mouth of the fossa was bounded on the left by the left colic branch of the inferior mesenteric artery and vein; in front by an arterial arch which connects the middle colic artery with the left colic. Leaving this arch at its middle and behind it is the inferior mesenteric vein, while attached to the arch and enclosing it is the posterior lamella of the mesocolon. On the right the mouth is bounded by the middle colic artery and the trunk of the superior mesenteric. Posteriorly is the third portion of the duodenum and the renal artery.

The anterior wall of the pouch is bounded by the pancreas; the posterior wall by the duodenojejunal flexure; the right by the superior mesenteric vessels; and the left by the descending colon and anterior half of the left kidney.

This fossa offers an excellent site for lodgment of an internal abdominal hernia.

DR. W. G. ELMER remarked that one should be careful not to be led into error by examination of a late X-ray picture. If the ligament tears away the osteogenetic layer from the bone, it is open to supposition that a small island of bone may be formed in the vicinity of the bone from which it was supposed to have been torn away.

DR. ASTLEY P. C. ASHHURST said that it seemed to him that there was no need to exaggerate the frequency of sprain-fractures, when it was possible to explain the lesions in other ways. Drs. Ross and Stewart (*ANNALS OF SURGERY*, 1912, ii, 599, Fig. 4) included in their series of sprain fractures an experimental fracture of the coronoid process of the ulna which was quite clearly caused by direct violence and not by ligamentous distraction. So in the case reported by Dr. Skillern, it seemed to Dr. Ashhurst that the fracture might very well have been caused by direct violence.

REDUCTION OF OLD DISLOCATIONS OF THE SHOULDER.

DR. T. TURNER THOMAS presented a paper with the above title, for which see page 217.

DR. OSCAR H. ALLIS said that he possibly stood alone in one respect, he does not think any one gets a perfect result in dislocation of the shoulder. The mechanism of the shoulder is very peculiar in some respects; as all know, muscle has the function of stretching within prescribed limits. When the head of the humerus is thrown suddenly into the axilla the short muscles of the scapula, its normal retainers, are apt to be torn in two or stretched with interstitial tearing of the muscle-fibres, so that after restoration there will be a later atrophy and tendency to a second dislocation. A tendency to a second dislocation is not necessarily because the capsule does not unite, but because it has no longer these little muscles to hold it in position. He was inclined to think that no one ever gets the full amount of motion after one of these dislocations. In a paper read before the College of Physicians on one occasion he stated the theory that the dislocation takes place through muscular action when the arm is thrown away from the body. He had seen a number of such cases. A person going downstairs makes a misstep and throws the arm out, producing a dislocation, although the individual does not fall. When Dr. Thomas said that he does not believe that the opening or laceration in the capsule is ever so small that the head cannot be replaced, he was sure experimental work bore that out. The old theory of a slit in the capsule cannot be held by any one that has done any experimentation.

DR. D. L. DESPARD said that traction prolonged over a number of days possesses some advantages over the method of applying a great force only at the time when reduction is being attempted. The former method of traction was successfully used recently in the dislocation of the shoulder of an exceedingly muscular man. The injury had existed for over six weeks and he had anticipated a great deal of difficulty in effecting a reduction. By means of Buck's extension apparatus, traction was started with 6 pounds, which was gradually increased to 10 pounds and continued over a period of 8 or 9 days. The patient was then anæsthetized and reduction effected by the Kocher method upon the first attempt.

DR. JOHN H. JOPSON said that he had always found Dupuytren's modification of Mothe's method easier than the Kocher method. It consists in drawing the arm directly upward fully extended in a broad sweep while counter-pressure is made by an assistant's fist in the axilla.

DR. A. P. C. ASHHURST remarked that all methods of reducing dislocations might be classified, either as *direct* or *indirect*. Dr. Thomas advocates one of the direct methods; it is the same as Stimson's or Sir Astley Cooper's, only it is applied differently. Stimson puts the patient in a sort of sling and lets the arm hang through a hole in this sling, attaching a weight to the hand. Cooper pulled the arm away from the chest, using the foot for counter-pressure. When the head of the humerus is brought away from the side of the chest and opposite the glenoid process of the scapula, then it is pushed or pulled into the socket, either by manual pressure as in Stimson's and Thomas's methods, or by leverage over the foot, as in Astley Cooper's method. All of these are direct methods, similar in principle to Allis's method for reduction of dislocations of the hip. In this sense there was nothing new in Dr. Thomas's application of this principle to the shoulder. Henry H. Smith's, Kocher's, and other methods of the kind are so-called indirect methods, like Bigelow's.

It was interesting, Dr. Ashhurst thought, to recall that anæsthesia not only made reduction much easier, but that it demonstrated that it was not only the muscles which interfered with reduction. Though Kocher was the first to recognize that the ligaments were the main obstacle to reduction in dislocations of the shoulder, as Moses Gunn had been the first to recognize their action at the hip, Kocher's claim that the coracohumeral ligament acted at the shoulder as did the iliofemoral at the hip was demonstrated to be false by Farabeuf, who showed that the essential structure was the posterior part of the capsule.

The end results of dislocations of the shoulder formed an interesting subject. Though the reports of consecutive series of cases are meagre, it appeared that two out of three patients have been found to present persistent debility. Out of more than 20 patients under the speaker's own care, it had been possible so far to ascertain the end results only in five cases. In only two of these was perfect function regained; the three other patients were quite satisfied with their condition, though two of these had had the same shoulder dislocated twice or more subsequently,

and the third had distinct limitation of motion, though subjectively he claimed his shoulder was "all right."

DR. GWILYM G. DAVIS remarked that this discussion had broadened out into recent as well as old dislocations. Etherization eliminates the consideration of muscle resistance, but as regards the difficulty of replacing luxations if no anæsthetic is given, then the muscles play an important part as a hindrance to replacement; in shoulder luxations it is often thought unnecessary to give an anæsthetic. Then the elimination of the muscles must be undertaken by other means, hence it is that use is made of the methods of Stimson, Astley Cooper, and others, by direct traction, etc., all with the idea of overcoming the muscle resistance. When this is overcome by an anæsthetic then the bones and ligaments only are to be dealt with, and the reason that the luxation cannot at times be reduced under these circumstances is because, as Dr. Allis has shown in the hip, the arm is not placed in the correct position. Thus, when Stimson puts the arm through the sling he lets the weight swing and the arm swings round until the capsule is opened and the head slips in. The same thing occurs in the Astley Cooper method,—when the arm is rotated it opens the rent and in goes the head, and it is the same with all the direct methods. In the old method of hanging the patient over the top of a door, the arm rotates until the capsule is open to its greatest size, when the head will slip in. If traction is made in abduction and backward, absolutely eliminating the muscles by anæsthesia, then the only thing to do is to rotate until the capsule is open, and push the head in. If it does not go in, then there is an irregularity in the condition; it is not a true simple luxation but one complicated with a fracture, etc. When it comes to the method, the speaker agreed with Dr. Thomas that this is the proper method of reducing luxations of the shoulder. He had had several cases in which he had put the foot against the bedstead and pulled outward and backward and rotated; the longest time taken for reduction was fifteen minutes, while in others it was effected in three minutes. Kocher's method is unnecessary although effective if it is desired to reduce without an anæsthetic. Reduction does not depend solely upon the coracohumeral ligament. This ligament goes from the coracoid process, which is to the inner side, outward and in front. It has near it the long tendon of the biceps and the glenohumeral ligament. Above is that part of the cap-

sule which frequently remains untorn in the cases in which the Kocher method is effective. One can determine on the cadaver that when the upper and posterior parts are intact one can rotate the humerus, and the head will move out from the chest toward the glenoid cavity. But if that portion of the capsule is torn, the head will bore between the glenoid process and the side of the chest, and in order to reduce such a luxation all that is necessary is to proceed with the direct method as the capsule is all torn. In such cases the Kocher method is ineffective. In the old cases in which that part of the capsule is intact then the Kocher method is effective because one can wind the remaining portion of the capsule around the upper portion of the head of the bone and push it outward, and it pushes in the old cases the supraspinatus, infraspinatus, and teres minor off of the glenoid process and cavity. The Kocher is the most dangerous method, because if the external rotation is made when the arm is down by the side, as is so often taught, then the coracobrachial is stretched so firmly over the head of the humerus that the lesser tuberosity catches on it and prevents it being rotated outward, and not infrequently the head of the humerus is jammed so tightly between the glenoid process of the scapula and the side of the chest that if one persists in rotating outward one will fracture the bone. It is far safer to do a wide abduction and traction.

DR. T. TURNER THOMAS (in closing) said that he did not mean to infer that the abduction method was new. It is much older than the Kocher method, but what he had tried to show was that one of the older methods is more effective than the new, or Kocher method, which has been the prevailing method almost from its introduction. In regard to the Stimson method for recent dislocations, the underlying principle is the same as that which he had been applying in old dislocations. With regard to the disabling limitation of movement after the reduction of old dislocations, if the dislocation has existed for many months before reduction, the chances for a complete return of function are small. He would not say that it is impossible to get it. The return of function will be more rapid and will more nearly approach the normal after a non-operative reduction than after an operative reduction, as a rule. The underlying cause of the difficulty is essentially the same as for the corresponding condition found after the reduction of recent dislocations, *i.e.*, the stiff and painful shoulder of which so much has been written in re-

cent years. The cicatricial contraction at the site of the capsule tear in the axilla will be more unyielding after the reduction of the old dislocations than after the reduction of the recent. He had, in a considerable number of cases of the latter variety, broken up this resistance by forcible manipulations under ether, without trouble and with very satisfactory results.

He had had very little experience with recent dislocations, since these are usually reduced by the family physician or the hospital interne, so that in discussing the abduction method he had confined himself to the old dislocations.

The superiority of the abduction method should be more evident in the reduction of dislocations of the shoulder associated with fracture of the surgical neck of the humerus, just as the Allis method is superior to the Bigelow method in the corresponding condition at the hip. The Kocher method may have the advantage in the reduction of recent dislocations, without an anæsthetic, in very powerful individuals. Such patients can resist more effectively the simple, direct pull in abduction than a series of more or less complicated movements as in the Kocher method, although the general spasm may effectively resist all these.

Stated Meeting held November 4, 1912.

DR. GWILYM G. DAVIS, President, in the Chair.

STAB-WOUND OF THE HEART; RECOVERY AFTER SUTURE.

DR. CHARLES F. MITCHELL presented a colored man, 59 years of age, who was brought to the Pennsylvania Hospital by the patrol at 5 P.M., July 30, 1912, having received a stab-wound of the left chest a short while before. He had been drinking heavily, and there was a marked odor of alcohol on his breath. His previous history was negative, except that he always used alcohol to excess. He was admitted to the service of Dr. Richard H. Harte, in whose absence Dr. Mitchell was called upon.

On admission temperature was normal, pulse 90 to the minute, while breathing was rapid and rather labored. There was no sweating, lips and conjunctiva blanched, heart sounds regular, but rather faint. Arteries atheromatous, marked arcus senilis. Area of cardiac dulness not increased. Right chest normal, but signs of pneumothorax over whole left chest. There was some

dulness of left chest posteriorly. In sixth left interspace in anterior axillary line was a stab-wound, about $1\frac{1}{2}$ inches in length, from which bright red blood was flowing.

From above symptoms and physical examination a penetrating wound of the chest was diagnosed with probable injury to the heart. At 6.24 P.M., 1 hour and 24 minutes after admission, the patient was given ether preceded by ethyl chloride. The field of operation was sterilized with 3 per cent. iodine solution and wound in interspace enlarged. Left lung was found collapsed. The sixth rib was then divided and retracted, and immediately a large opening was found in the pericardium. The edges were rough and the wound appeared to be more like a tear than a clean cut. There were a number of clots found in the pericardium, which when removed showed a transverse cut in the heart, from which at each systole there flowed bright red blood. The cut in the heart was about one inch in length, apparently in the left ventricle about an inch above the apex. A curved intestinal needle, threaded with fine Pagenstecher thread, was then passed through the cardiac muscle and tied, the ends being left long and used as a tractor in the introduction of the second stitch. When the second stitch was tied, it was found that the wound was completely closed and the hemorrhage from the heart stopped. The pericardium was then partially closed, after its cavity had been washed out with normal hot solution. A small gauze drain was left in the wound and the retractor holding the rib withdrawn, and the wound closed with silk-worm-gut sutures. There was no hemorrhage from the chest or pericardium, and no ligatures were used during the operation.

Previous to the operation the patient was so well stimulated by the alcohol already imbibed, that he did not require any stimulation, either before, during, or after the operation. He apparently left the operating table without any symptoms of shock, his temperature being 96.4° , pulse 88, respiration 32. Time of operation 22 minutes. During the night he was given a sixth of morphine hypodermically, but this is all the medication he received. The following morning his temperature rose to 101° , pulse remained about the same (92), respiration 36.

On August 2, three days after admission, he developed delirium tremens, and was irrational for a couple of days. On August 5 a to-and-fro friction rub synchronous with a heart-

beat was noted to the right of the sternum at level of the third rib. This disappeared in three days. There apparently was no increase of cardiac dulness or other signs of cardial effusion. Temperature at this time was 100° , pulse 100, respiration 28. Drain was removed on August 17. Patient sat up in bed at this time. On August 21 dulness in the left chest posteriorly, with distant breath sounds, was noted over this area. Temperature 102.3° , pulse 124, respiration 28. On August 26 chest was aspirated and about eight ounces of a dark reddish, clear fluid evacuated. Upon culture this was found to be sterile. On September 14 chest was again aspirated, but only a small quantity of the same sort of fluid obtained. From this time on, patient rapidly improved. Signs of fluid in left chest diminished and when patient left the hospital on October 19 there was but slight dulness over left chest posteriorly, probably due to a thickening of the pleura. The heart at this time seemed to be slightly pulled to the left, apex beat being in sixth interspace one inch to the left of the nipple line. There were no murmurs present, sounds regular but a trifle rapid. Dr. Mitchell added that so much has been written of late as to the treatment of heart wounds that it does not seem necessary at this time to go very deeply into this subject.

König¹ in his article on "Technic for Access to Suture of the Heart," gives a full discussion on this subject, and Poole,² gives a most exhaustive study of the technic, as well as the bibliography of recorded cases up to the year 1912. He has succeeded in tabulating 77 cases of heart suture, which added to those already tabulated in 1909 by Peck totals 236.

Ranzi³ gives Rehn the credit of publishing the first successful case of heart suture in 1896, and has collected 223 operative cases with a mortality of 53.3 per cent. He adds to this number three cases of stab-wound and also three of gun-shot wound of the heart, who were operated upon in Von Eiselsberg's Clinic at Vienna, but only one of which recovered. He mentions in the successful case, that five hours intervened between the time of injury and operation, and states in naming the time of the the operation that the anæmia was not very marked.

¹ Deutsche Zeitschrift für Chirurgie, vol. cxii, Nos. 4 and 6.

² ANNALS OF SURGERY, April, 1912.

³ Wiener klinische Wochenschrift, Vienna, Dec. 14, vol. xxiv, No. 50.

Bircher⁴ reports a case of gun-shot wound of the heart which healed under conservative measures alone, and also reports a case of multiple stab-wounds of the heart requiring operative treatment, which case recovered. He goes on to say that only one stab-wound was found at the first operation and the second wound required suture twelve hours later. At the time of the second operation the wound first sutured showed that firm repair had already begun to take place. He states that conservative measures seemed more promising for gun-shot wounds, and intimates that operative procedures are necessary in all cases of stab-wound.

It is needless to say that all stab-wounds of the heart require surgical intervention, and that all wounds in the neighborhood of the heart should be explored, as this is the only positive method of determining the extent of the injury done.

When the symptoms of extreme shock accompany a wound of the chest in the cardiac region, the diagnosis is fairly sure of an injury to either the pleura, pericardium, or heart, but this cannot fully be determined without exploratory procedure; as in the case above cited, the symptoms were those of an injury to the pleura, whereas at operation we found not only the pleura injured, but the pericardium and heart as well.

As to the method of operating in these cases, I do not believe that any fixed rules can be laid down other than those of expediency. Usually the enlarging of the original wound (Peck) and the division of the costal cartilages, the retraction of which will allow a good exposure of the heart, is all that is required. Kocher and others suggest various flap methods. Kocher divides the fifth, fourth, and, if necessary, the third costal cartilages, while Wilms recommends the intercostal incision, as it can be much more quickly performed than the various flap methods. In the majority of heart wounds the pleura is injured. Sauerbruch says that 80 per cent. of the cases are so complicated.

As to the suture material, either well-vaselined silk, chromicized catgut, or Pagenstecher may be used. In our case Pagenstecher thread was the one selected. No doubt the use of the differential pressure apparatus is of great advantage in the administering of the anæsthetic, but when this apparatus is not available, ether, by the drop method, is the most efficient method.

⁴ *Archive für klinische Chirurgie*, Berlin, vol. xcvi, No. 4, pages 831-1075; last indexed, April 27, page 1318.

The pericardium may or may not be completely closed. If there is much injury it is better to partially close it by interrupted sutures and carry a small drain down to the opening that is left so as to drain the excessive serous discharge which is apt to occur as a result of the traumatism. Drainage of the pleural cavity may or may not be done at the primary operation; it depends on the likelihood of infection. In doubtful cases it should always be performed. Poole says it is better to delay drainage until infection has occurred and then to perform a secondary thoracotomy.

DR. FRANCIS T. STEWART remarked that it was an error to give credit to Rehn, of Frankfort, for the first suture of the heart. Farina and Cappelen each operated in 1896, but the patients died. In 1897 Rehn published the first successful cardiorrhaphy. So far as he was aware there had been 11 cases of suture of the heart in Philadelphia, one by Dr. Mitchell, two by Dr. Gibbon, one by Dr. Bradbury, one by Dr. Billings, one by Dr. Harte and five by himself, nine of these having been cared for at the Pennsylvania Hospital. As to the diagnosis, in the beginning it is often a matter of doubt. He had explored a number of thoraces for wounds and had found only five cases in which the heart was wounded, although in many a wound of the heart was suspected. Simply from the degree of shock no conclusion can be drawn. He remembered one case of stab-wound over the heart which appeared as if there must be a wound in this organ, but it was found on examination that the knife had not penetrated the thorax, the patient suffering only from emotional shock. In some of the cases in which the thorax is penetrated the heart is seriously disturbed because of so-called concussion of the heart, the heart being merely bruised. This is more frequent in gun-shot wounds. In several cases that he had explored the pericardium had been wounded but not the heart, but the symptoms were indicative of a wound of the heart. The most reliable symptoms, when they exist, are those of compression of the heart (cyanosis, distention of the veins from pressure on the auricles, etc.). These symptoms are not conclusive, however, because effusion of blood into the pericardium may result from wounds of the vessels of the pericardium or the great vessels at the base of the heart. The site of the wound is usually over the heart, although in some cases it is in the axilla or even in the abdomen. No conclusions can

be drawn from external bleeding, because serious bleeding may proceed from a wound of the internal mammary artery or from the intercostals. The diagnosis can be assured only by exploration. His own custom in these cases has been to incise the skin; if the wound penetrates the muscles, to incise the muscles; if it penetrates the thorax, to enlarge the wound throughout its entire depth and to expose the pericardium; if a wound is found in the pericardium, to enlarge that wound, perhaps by resection of a rib above or below, or both. But if, on exploration, the symptoms of a wound of the heart being present, it is found that the pericardium has not been wounded, or no wound is discovered, then the pericardium should be punctured with a needle, because, although one who has had no experience in this class of surgery may think it easy to determine whether or not blood is in the pericardium simply by inspection, it is not always an easy matter, as has been proved by several reported cases. If there is doubt after a needle has been put in the pericardium, this membrane should be incised in order to allow full exploration. As to the method of exposure, it is a matter of expediency. The size and shape of the incision or flap must be determined by the situation of the external wound and the situation of the stab in the heart. If a flap, consisting of one or more ribs, is turned inward, the pleural cavity will always be opened. If a flap is turned up or down double section of the intercostals is necessary. Whenever possible the flap should be turned outward, toward the arm. In this way, if need be, the pleura can be separated without injury, and the exposure made extra-pleurally, as in one of his cases, a wound of the auricle, where he was able to make a large flap, to push off the pleura, which was not wounded by the knife, to expose the pericardium over a wide area, and to suture the wound in the heart without injury to the pleura; the patient made a rapid recovery. If the pleura is wounded infection usually follows. About one-half of the cases die of empyema of the pleural cavity or pericarditis or infective myocarditis, etc., so that if infection can be avoided the number of recoveries will be vastly increased. Of those that recover, about one-third do so in spite of infection. Of the five cases operated on by himself three recovered, two in spite of infection. As surgeons now recognize that wounds of the heart should be sutured and it has been demonstrated

that the hemorrhage can be controlled, the greatest problem is to learn how to prevent the infection. He mentioned three things as being of some value in this direction. First, the rapid disinfection of the skin with iodine. In most of the cases he had operated on he used soap and water, alcohol, and bichloride of mercury, which takes a little too long, if done properly, and is not very sure if done hurriedly. With a 10 per cent. tincture of iodine solution the disinfection can be done rapidly and certainly. In the second place, if possible, drainage should be avoided; careful hæmostasis should be made and clots removed, as those which remain either form adhesions or encourage infection. If empyema arises later it can be drained. Third, that the presence of air in the pleural cavity must if possible be avoided, at least after operation. He did not know of any case having been operated on with the positive or negative pressure apparatus. In his last case he intended to use a home-made Auer-Meltzer apparatus, but the different parts could not be assembled quickly enough. The question arises, however, as to whether suction upon or distention of the lung may not increase the bleeding. If a positive or negative pressure apparatus is not at hand, the air in the pleural cavity should be removed by aspiration, after the wound in the chest is closed. A pleura full of air contains a large number of bacteria, which, after they have settled on the pleura give rise to infection. If the lung can be expanded the chances of infection will be less. In one case in which he opened the thorax for exploration, finding a wound of the lung and not of the heart, the patient was treated in this way and recovered without difficulty or infection.

DR. W. JOSEPH HEARN said that a few years ago a colored woman was brought to the Jefferson Hospital one morning with evidence of puncture of the heart (stab-wound), and one of his medical delegates examined her carefully with the stethoscope and was satisfied there was leakage from the heart and suggested immediate operation, which he attempted. He made a U-shaped incision, turning the two bows of this flap toward the sternum, and avoided cutting the mammary vessels. He made an incision through which he could almost put his hand, and after washing out with salt solution, found an opening one inch long in the pericardium; the pericardial wound was enlarged sufficiently to see there was no wound of the heart,

merely a scratch, which had been made by the point of the knife. It was simply a wound of the pericardium into which he put 2 or 3 sutures, closing the wound without drainage. The woman 2 years later died of phthisis. His method of exposure gave a good view of the heart without much hemorrhage. The only difficulty encountered in sewing up the pericardium was the heart movement.

PERIRENAL HÆMATOMA.

DR. JOHN SPEESE read a paper with this title.

DR. FRANCIS T. STEWART remarked that he had never seen a spontaneous perirenal hæmatoma, but when Dr. Speese read his explanation of the tympanites it reminded him of the tympanites of other renal lesions, particularly of renal colic, which must be purely nervous in origin. On two occasions he had been asked to operate on a patient for intestinal obstruction who was found to be suffering from renal colic, and recently he had seen another case of the same character.

DR. CHARLES H. FRAZIER was reminded of a case presented by him to the American Medical Association five or six years ago. This was a young man 25 years of age, who was brought to the hospital 36 hours after the onset of his illness, believed to be suffering from an acute abdominal lesion. Upon examination after admission there was found board-like rigidity of the right side, exquisite tenderness on pressure midway between the appendix and gall-bladder, and also tenderness, but not to the same degree over the right kidney. There was marked acceleration of the pulse, leucocytes were 25,000, and an elevated temperature was present. An exploratory incision was made in the right rectus, nothing was found in the peritoneal cavity and the wound was closed. An incision was then made over the right kidney. A very large perirenal hæmatoma was exposed. Drainage was introduced and the patient made an uneventful recovery. The hemorrhage was attributed to a cortical tubercular lesion. The patient had pulmonary tuberculosis.

AN APPROACH TO THE HYPOPHYSIS THROUGH THE
ANTERIOR CRANIAL FOSSA.

DR. CHARLES H. FRAZIER read a paper with the above title, for which see page 145.

DR. JOHN H. JOPSON mentioned a case of fracture of the skull in which the line of fracture extended to the roof of the

orbit and the patient developed a panophthalmitis. Dr. Shoemaker, who performed the enucleation, stated at the time that this condition was a not infrequent complication of fractures involving the orbit. It had occurred to him that in the operation described by Dr. Frazier, some such pathological condition in the eyeball might result.

DR. CHARLES H. FRAZIER remarked, in response to what Dr. Jopson had said of involvement of the orbit, that great care should be exercised in separating the periosteum from the roof of the orbit before any attempt is made to remove the bone. The periosteum is quite thin there and may be readily torn unless one proceeds cautiously. It is rather presumptuous at this juncture to say that the transfrontal method of approach will be preferred to others, particularly the transphenoidal route. He could not, however, help but feel that surgeons will never become accustomed to working through such a long and contracted avenue as is necessary when approaching the sella through the sphenoidal sinuses. For the nasal specialist who is accustomed to open and drain the sphenoidal sinus, it may be a simple matter to go a step further and remove the thin shell of bone which forms the floor of the sella turcica. Or if nothing more than the removal of the floor of the sella, a sella decompression, is contemplated, the transphenoidal route may be given preference; but if one wants an exposure of the sella turcica sufficient to enable one to see the character of the lesion to be dealt with, some method other than the intranasal method of approach will be found to be absolutely essential.

THE FORMATION OF AN ARTIFICIAL VAGINA BY INTESTINAL TRANSPLANTATION.

DR. FRANCIS T. STEWART read a paper with the above title, for which see page 210.

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MARCH, 1913

No. 3

ORIGINAL MEMOIRS.

MYOSITIS OSSIFICANS TRAUMATICA.*

A REPORT OF THREE CASES ILLUSTRATING THE DIFFICULTIES OF
DIAGNOSIS FROM SARCOMA.

BY WILLIAM B. COLEY, M.D.,
OF NEW YORK.

Professor of Clinical Surgery in the Cornell Medical School.

CASE I.—*Myositis ossificans traumatica of quadriceps extensor*.—J. B. N., the patient, a boy of nineteen, had always been in good health up to November 17, 1906, when he received an injury to his right thigh while playing football. There was no external evidence of the injury noticeable that night, but the next day there was some swelling; two to three days later the leg became stiff, and the stiffness seemed to be confined to the region of the quadriceps muscle, greatly limiting the flexion at the knee. There was no pain at any time, but the swelling steadily increased in size. The patient at first believed the swelling to be in the muscle rather than the bone. The swelling slowly began to get hard and contract; the patient's general condition remained unimpaired. He was examined by a number of prominent surgeons and all agreed that the trouble was sarcoma, and amputation was advised. My opinion was asked by letter, and I replied that if the trouble was sarcoma I would advise a brief course of the mixed toxins treatment before amputation. Thereupon the toxins were administered for about four weeks with little reaction and no apparent effect on the size of the tumor. I declined to give further advice without seeing the patient, and he

* Read before the New York Surgical Society, December 11, 1912.

was referred to me early in April, 1907, by Dr. Wm. D. Haggard, of Nashville, Tenn. Physical examination showed a tumor situated in the middle and lower thirds of the anterior portion of the shaft of the left femur. The consistence of the tumor was extremely hard, much harder than usual in periosteal sarcoma. The X-ray photograph showed a sharp line of demarcation between the tumor and the shaft of the femur along the periosteal line, with no indentations in the periosteum. I made the diagnosis of myositis ossificans and under ether removed a piece of the tumor for microscopical examination, and advised no further treatment. The patient has continued in good health up to the present time, 5¾ years later. The specimen was examined by Dr. Jas. Ewing, Professor of Pathology at Cornell University Medical School. This report reads as follows:

April 12, 1907: Material received consists of several small masses of bony tissue. After hardening in Müller-formol and decalcifying, sections were stained in eosin and hæmatoxylin. The tissue is composed of numerous trabeculæ of bone, round, elongated, branching, and anastomosing, as in cancellous tissue. These masses are usually well calcified, but some are deficient in ossification, in the centres where the material stains bluish. They are often surrounded by numerous large osteoblasts which are evidently in the process of bone formation. In a few areas there are scanty giant osteoblasts, lying in lacunæ or at some distance from the bone tissue. Between the bony trabeculæ the tissue is composed of cellular connective or of fat. The connective tissue is very cellular and appears to be of new formation. The fat tissue is inflamed, infiltrated with new cells, chiefly lymphocytes, and the fat is being absorbed. There are no traces of muscle tissue in the section.

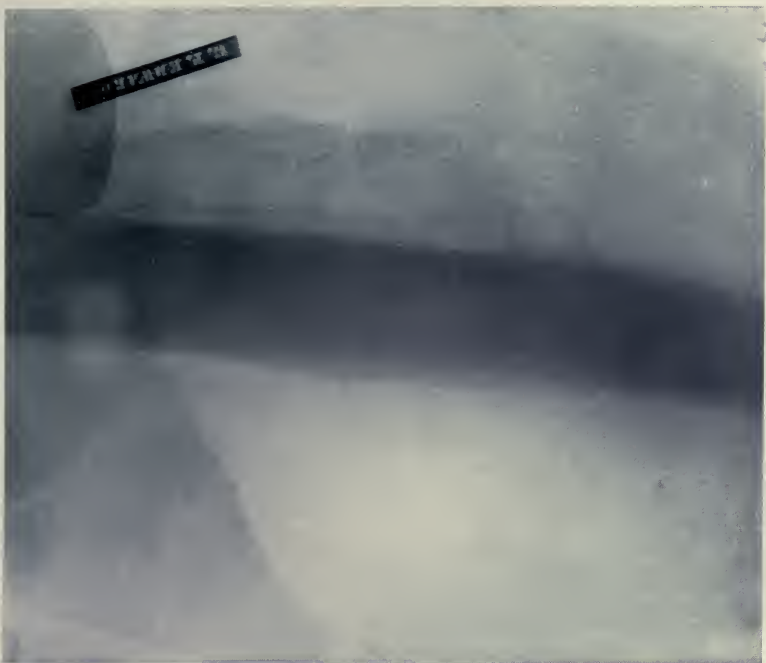
Dr. Ewing stated that the condition was one usually termed myositis ossificans traumatica, though chronic productive osteitis might be a better term.

Under date of November 13, 1912, the patient writes:

"On palpation I cannot notice much reduction in size of the growth. The interference with movement is very slight, being able to almost completely flex my leg. It gives me no trouble at all, save for an occasional slight uneasiness just sufficient to attract one's attention. My general health is good."

The first X-ray illustration shows the condition prior to operation.

The second X-ray photograph, taken by Dr. A. F. Holding,



Myositis ossificans, 1907. (Case I.)



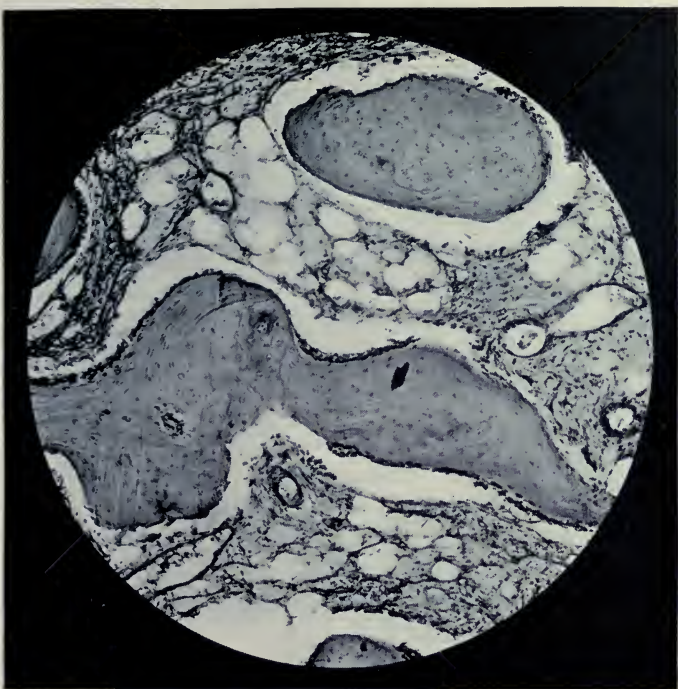
5 3/4 years later, December 1912. (Case I.)



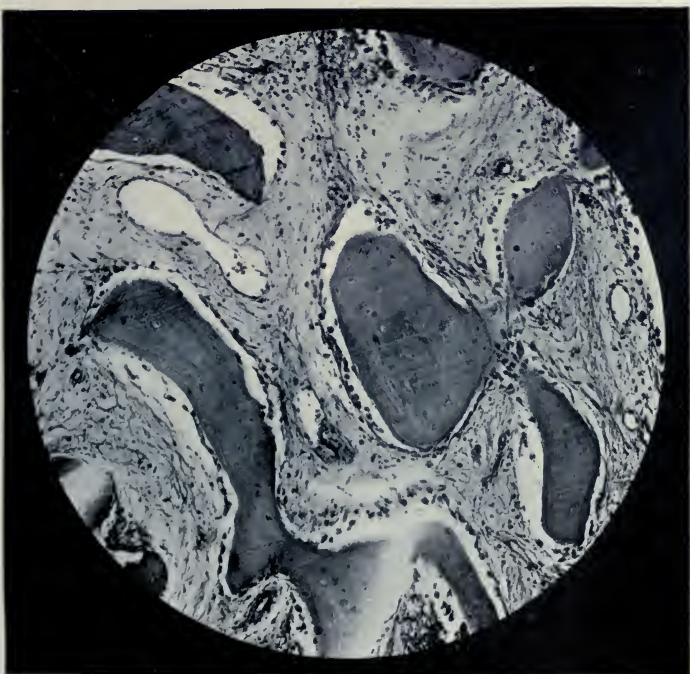
Myositis ossificans. (Case I.)



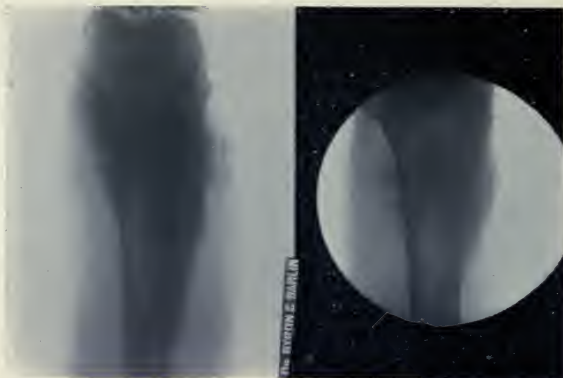
Myositis ossificans. (Case I.)



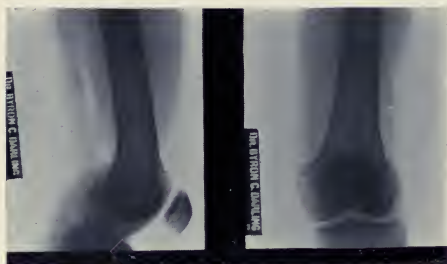
Myositis ossificans, 1907. (Case I.)



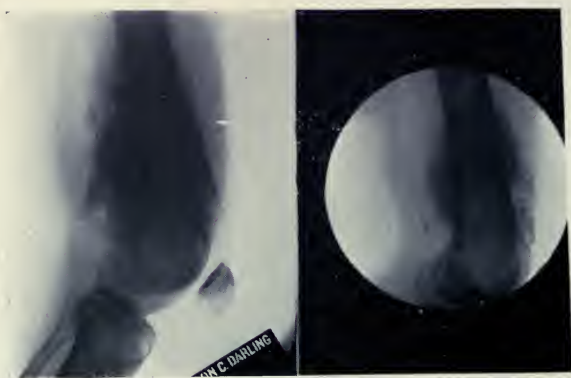
Myositis ossificans, 1907. (Case I.)



Interval, 2 years 2 months—May, 1909—July, 1911. (Case II.)



Normal knee. (Case II.)



Interval, 2 years 2 months—May, 1909—July, 1911. (Case II.)

December 11, 1912, shows the condition almost identical with the second radiograph of Mr. Makins's case, taken six years afterward. It shows that much of the original bony tumor has been absorbed.

NOTE.—The patient, now a physician, was shown before the New York Surgical Society Dec. 11, 1912.

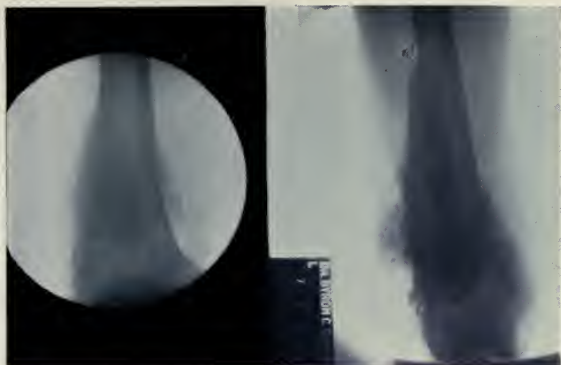
CASE II.—*Myositis ossificans of muscles and ligaments, lower end of femur, becoming sarcoma six years later.*—The patient, Miss A., aged twenty-six, had always been in good health; negative family history. Seven years ago she was thrown from a carriage in a runaway accident, and received a very severe blow on the lower and outer part of the left thigh, just above the knee. After the immediate effects of the contusion had subsided she noticed nothing unusual until about two years later, when, on bathing, she saw that the left thigh just above the knee was somewhat larger than the right. There was no pain, no soreness, no lameness, the increase in size being the first sign she noticed. She consulted a physician who found a slight bony enlargement above the outer condyle of the left femur and an X-ray photograph was taken at that time, which showed a small bony tumor projecting about half an inch beyond the normal border of the shaft of the femur, not extending to the joint. This increased in size very slowly, was not painful and caused her no trouble. On February 9, 1909, the patient consulted a very prominent surgeon of the Middle West, who pronounced it subperiosteal sarcoma and advised hip-joint amputation. She was made very nervous by this decision and went abroad for two months to get in better physical condition. On her return, on May 3, she again consulted another very prominent physician of Chicago, who stated that she was suffering from a fibrosarcoma of the femur of periosteal origin. He stated that there was no possible doubt of the diagnosis and advised immediate amputation below the trochanter and urged this being done without a day's delay. She was brought to me for advice on May 5, 1909, by her family physician, Dr. Mary Spark of Indianapolis. Physical examination showed the patient in good general condition; examination of the left thigh showed a hard, bony tumor in the lower third of the left femur, smooth in outline, extending upward about two and a half inches, most marked on the outer side. Although it extended apparently nearly around the bone, the skin was perfectly normal in appearance and there were no enlarged veins. Comparison between the X-ray taken

a year ago and that of a few days ago showed some increase in size and extension across toward the other side of the femur; no involvement of the joint, and interior of bone not involved.

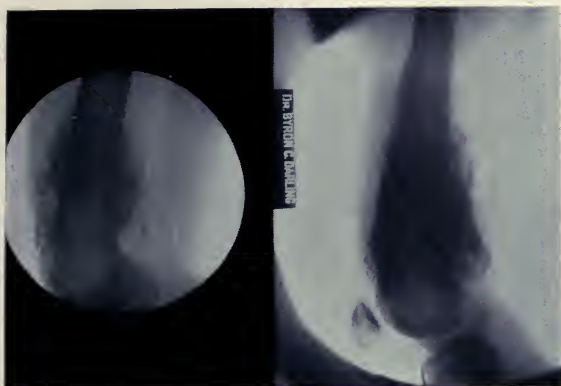
In both these cases there was a well-defined sharp line of demarcation between the bone and the tumor, differing strikingly from the irregular indentation almost always present in the case of sarcoma. The consistence of the tumor, too, was much harder and more bony in character than in true sarcoma. I believed the tumor to be some type of myositis ossificans originating from the trauma, and not sarcoma. I advised an exploratory incision under general anæsthesia and removal of a section of the tumor for microscopic examination. This was done on May 7. An incision three inches in length was made over the external condyle, the most prominent part of the tumor; on cutting through the fascia overlying the muscles and separating the latter, no periosteum could be recognized, a hard, bony tumor was found in close proximity to, and infiltrating, the muscles. A portion of this was removed with a chisel. Macroscopically it had every appearance and the consistence of cancellous bone tissue, deep red in color and in no way resembling the grayish-white appearance of sarcoma. This was sent to Dr. James Ewing, Professor of Pathology at Cornell University, who, after decalcification, made a careful examination and reported as follows:

May 17, 1909: Seven different portions of the material received are under examination. In none of them is there the slightest trace of any form of sarcoma. The tissue shows chronic osteitis and myositis, such as commonly arises after traumatism to the bone or periosteum. The changes in the muscle are not those typical of myositis ossificans and yet new bone appears to be forming in close proximity to the atrophying muscle. I should prefer to give the diagnosis of chronic formative osteitis.

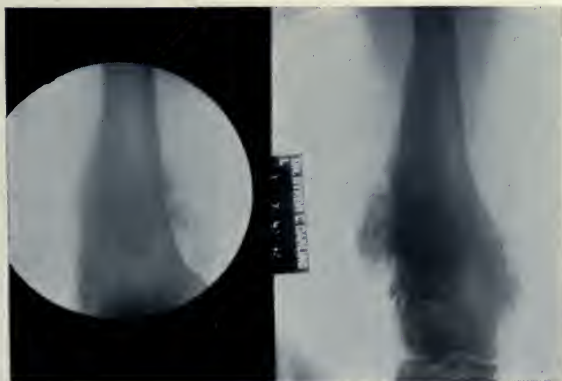
The history of this case thus far was related in my paper on "A Plea for More Conservative Treatment of Sarcoma of the Long Bones" (*Jour. of the Am. Med. Ass'n*, Jan. 29, 1910), but it is the later history of the case that has proved of particular importance and which makes it, as far as my own search of the literature goes, an entirely unique case.



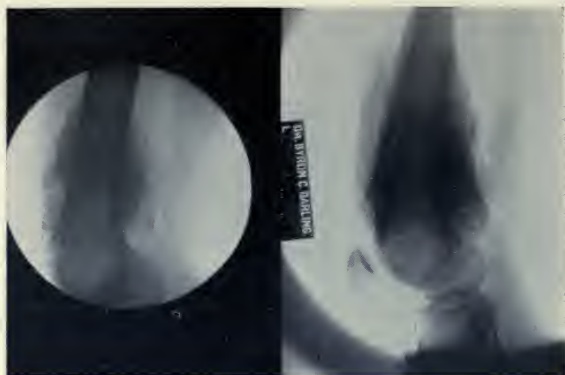
Interval, 2 years 5 months—May, 1909—October, 1911. (Case I.)



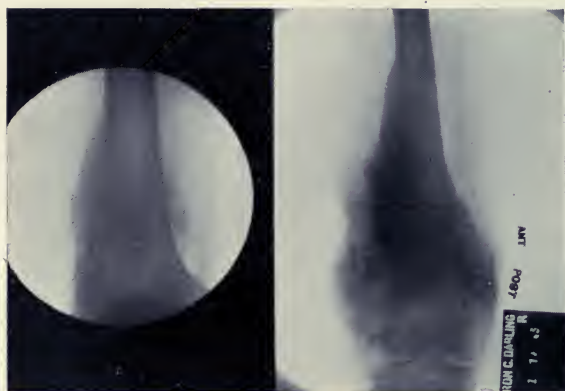
Interval, 2 years 5 months—May, 1909—October, 1911. (Case II.)



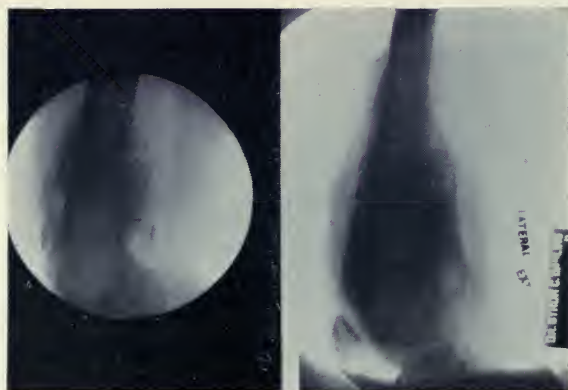
Interval, 2 years 8 months—May, 1909—January, 1912. (Case II.)



Interval, 2 years 8 months—May, 1909—January, 1912. (Case II.)



Interval, 2 years 11 months—May, 1909—April, 1912. (Case II.)



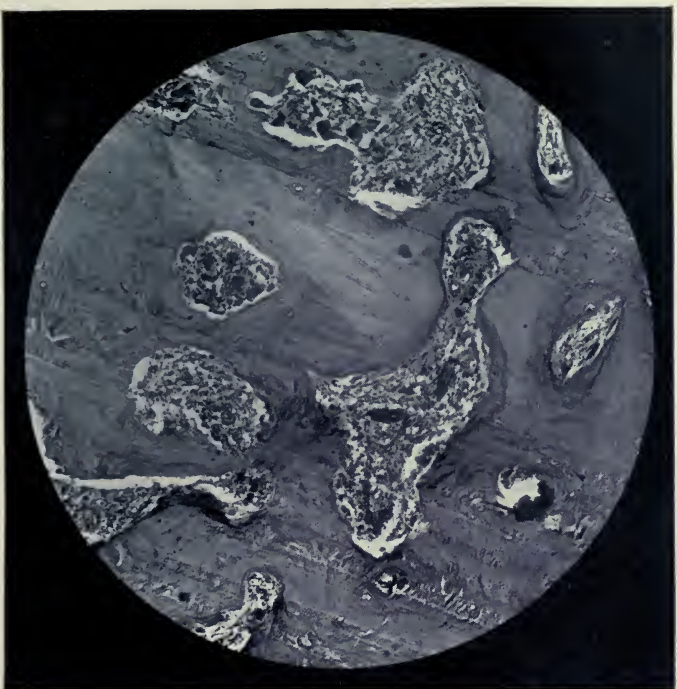
Interval, 2 years 11 months—May, 1909—April, 1912. (Case II.)

The wound healed by primary intention, and at the end of two weeks the patient returned to her home in the Middle West. She continued to enjoy perfect health and was able to ride horseback and play golf without any inconvenience. Two years later, in June, 1911, she called upon me while passing through the city and I examined the knee carefully. Physical examination showed a slight increase in the bony enlargement at the outer and posterior side of the femur and some thickening of the entire lower end of the shaft, just above the joint surface. There was very slight limitation in motion of the joint, and her general health was excellent. The tumor seemed to be of bony hardness, entirely different in consistency from the ordinary sarcoma. There was practically no change in its appearance from that of two years ago, except the slight increase in size already noted. An X-ray taken at this time by Dr. Darling and compared with the X-ray taken two years before also showed some increase in size and a less sharply defined periosteal line. I advised the patient to see me again in the fall on her return from the country, in order to have another examination made and X-ray taken. Owing to my absence in Europe, I did not see her until January, 1912. At this examination the enlargement seemed even more appreciable than it had been in June and I strongly advised another exploratory operation, thinking that possibly some change had taken place in the nature of the tumor. On January 8, assisted by Dr. Wm. A. Downes, my associate, I made an incision six inches long over the outer aspect of the lower end of the femur, and found a very hard, bone-like swelling, firmly fixed to the femur, in its upper portion, but in its lower portion there seemed to be a mass about the size of an olive that was slightly movable. This proved to be a bony tumor of typical cancellous structure, so hard that it could be cut only with a chisel. It was in no way connected with the periosteum or the femur, but apparently originated in the fascial portion of the adductor muscles just above their insertion, very closely attached to yet distinct from the larger bony mass which was continuous with the shaft of the femur. The smaller tumor was removed and the larger tumor mass was chiseled off on the anterior, lateral, and posterior portions, down to the level of the normal line of the femur. Nearly half a teacupful of bony material was removed, which, macroscopically, had the appearance

of healthy red normal cancellous bone, and in no place was there anything in any way resembling or even suggesting sarcomatous growth. All the material was sent to Dr. Jas. Ewing, Professor of Pathology at Cornell University Medical School, who, after careful examination, made the following report:

Feb. 15, 1912: The tissues in the case of Miss A. show the usual and some unusual changes of myositis ossificans. The process begins with fibrosis and atrophy of the muscle-fibres and the production of dense connective tissue. This is then followed by increased vascularity, and many islands of bone and some of cartilage are deposited. In the new connective tissue there are many very cellular areas with giant-cells which resemble those seen in giant-cell sarcoma. I do not think the process can be regarded as a tumor in all respects, but these cellular areas explain why it is persistent and progressive. It is on this evidence also that many assume that myositis ossificans is a true tumor process. At any rate I do not like the presence of these large cell groups. In all other respects the case is typical of active myositis ossificans.

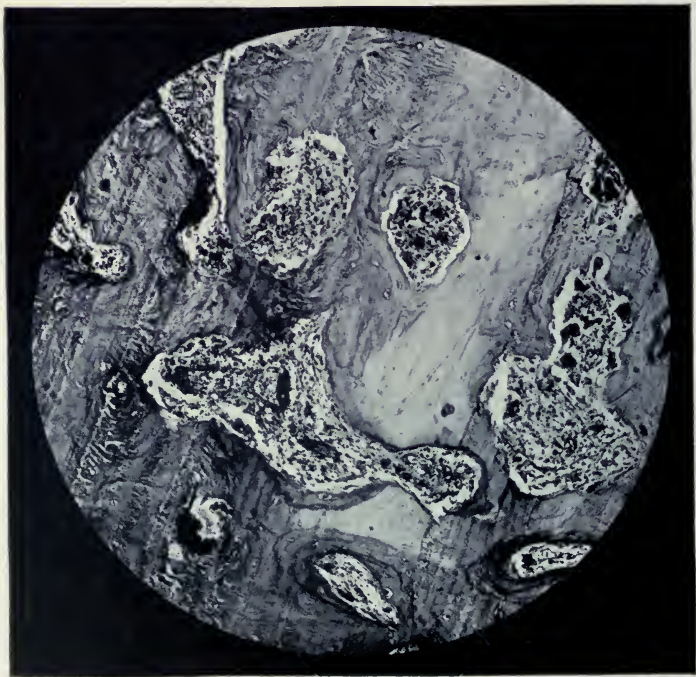
The skin wound was closed, with a gauze packing into the cavity which was of considerable size. The wound healed without any suppuration, and after ten days the patient was allowed to get up and rest upon a couch. A small drain was kept in the cavity for about six weeks, and finally the opening closed entirely. At the end of eight weeks the patient was allowed to go about on crutches. She seemed to have less power in the leg than was to have been expected, and there were occasional attacks of pain which had never occurred before. Two days before the patient's departure for home, there suddenly appeared a moderate effusion in the joint. The latter was strapped and bandaged and she was instructed not to use the leg for a few days, after which the swelling nearly subsided. She then (February 22, 1912), returned to her home in the Middle West, but the pain continued, she developed a slight temperature, 99°-100°, and a swelling appeared over the central portion of the incision at the site of the drainage opening. This swelling increased daily, the pain became more severe, and becoming somewhat nervous about her condition, she returned to New York on March 20. Physical examination at this time showed a marked protuberance over the whole line of incision, greatest at the central point, amounting to a projection of 1-1½ inches over the normal surface. The skin was smooth in outline, slightly purplish from enlargement of superficial veins, and semifluctuat-



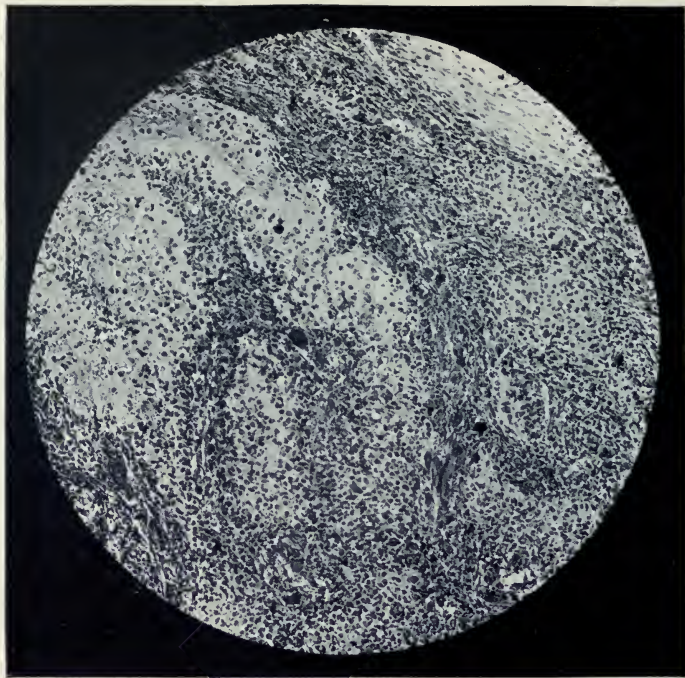
Myositis ossificans. Microscopical section, May, 1909. (Case II.)



Central portion ivory-like bone. Giant-celled sarcoma at lower and external portion. March, 1912. Death from metastases in pelvis and spine, January 12, 1913. (Case II.)



Myositis ossificans, January, 1912. (Case II.)



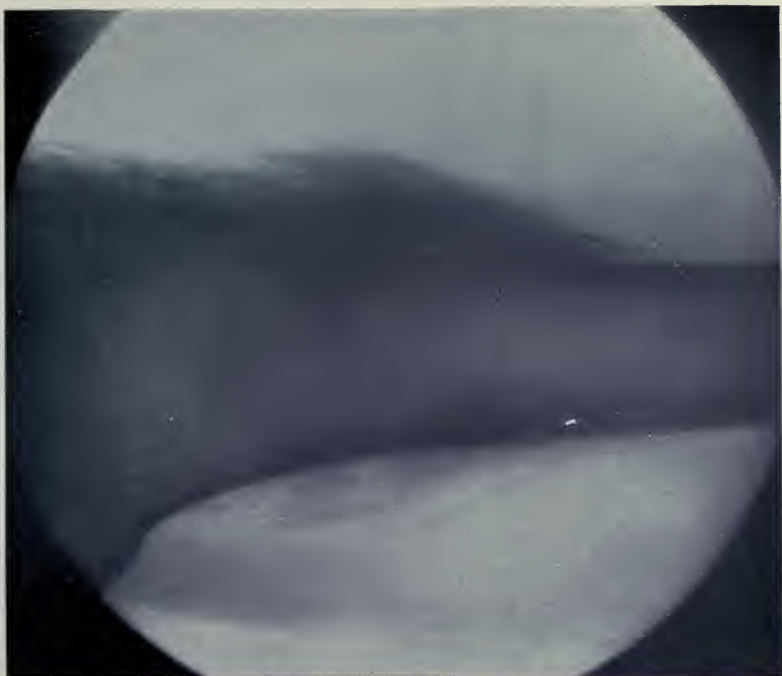
Giant-celled sarcoma, March, 1912. (Case II.)



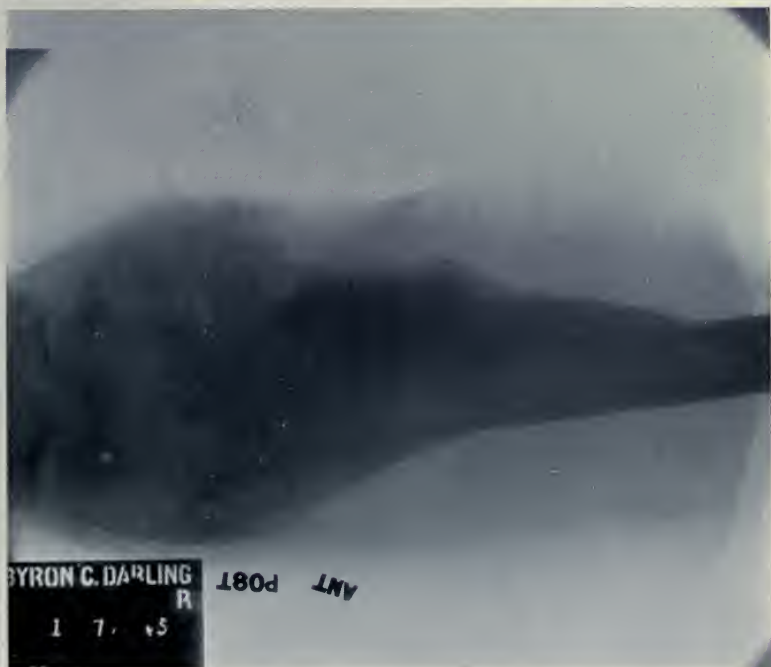
Myositis ossificans. Fungating sarcoma developing at site of exploratory incision. March, 1912. (Case II.)



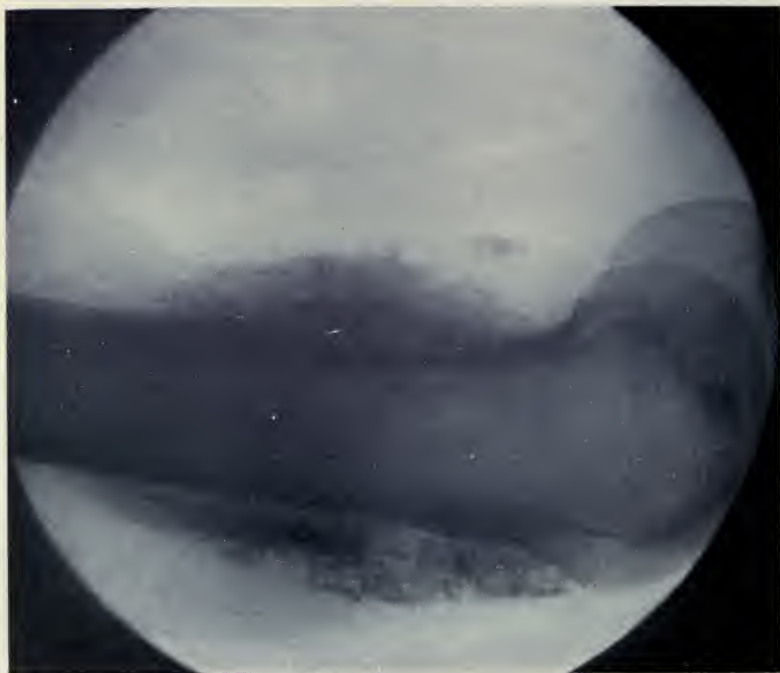
Longitudinal section showing central ivory-like bone, March, 1912. (Case II.)



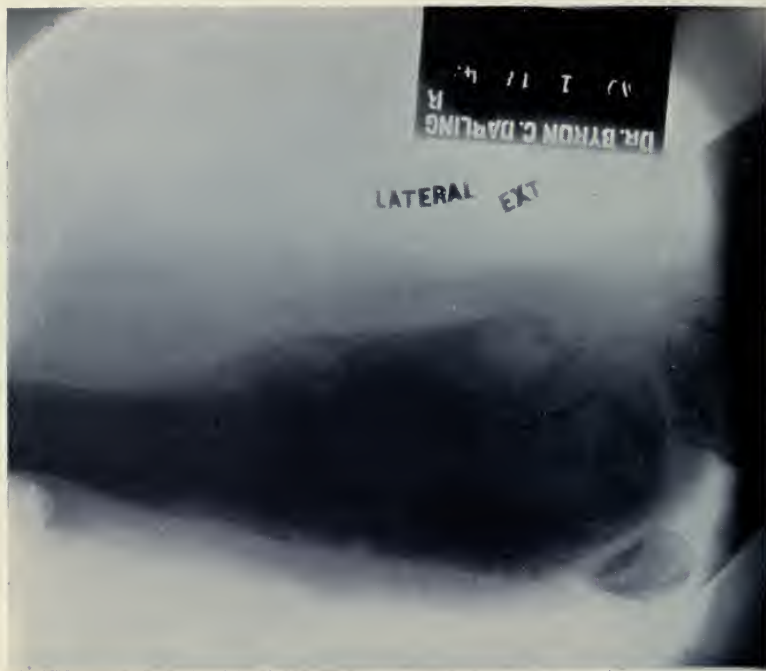
Myositis ossificans. May, 1909. (Case II.)



Myositis ossificans having become sarcoma. March, 1912. (Case II.)



Myositis ossificans. May, 1909. (Case II.)



Myositis ossificans having become sarcoma. March, 1912. (Case II.)

ing over the central area. In other words, the character of the tumor had entirely changed, and the clinical appearance was absolutely typical of a rapidly growing sarcoma. The introduction of a needle drew only blood. The swelling had come on so suddenly and was so soft as to be almost fluctuating, that the possibility of an accumulation of blood or serum in the old cavity was considered though not regarded as probable. Under cocaine I immediately made a small incision and curetted $\frac{1}{2}$ oz. of soft grumous material, which, clinically, had every appearance of sarcoma. This was examined by Dr. Ewing and pronounced giant-celled sarcoma. His report reads as follows:

April 15, 1912: The sections of the myositis ossificans have been completed. They show areas of ordinary myositis ossificans grading into very cellular areas and finally into sarcoma of giant-cell type. There is no doubt that sarcoma is the final expression of the myositis process. As you know, these giant-cell sarcomas are not always very malignant, and I am inclined to think that this one is not, but as it occurs in a peculiar condition I would prefer not to offer any prognosis.

Dr. V. P. Gibney and Dr. Wm. A. Downes were called in consultation, and after careful deliberation it was decided best to try the effect of the toxins for 2-3 weeks before sacrificing the leg. The patient's general condition had greatly deteriorated within the last few weeks; she was extremely nervous and apprehensive, and unable to bear more than minute doses of the toxins, not sufficient to cause any marked reactions. As there was no retardation of growth noticeable at the end of two weeks, it was decided to amputate. Accordingly, on April 22, 1912, I amputated the leg 5 inches below the trochanter. The wound healed by primary union, but the patient recovered her strength very slowly. It was intended to continue the toxins as a prophylactic against recurrence after the wound had healed, but her general condition was so poor that it was considered unwise to do so.

It should be mentioned that for a number of years she had had enlarged glands in both cervical regions; these glands increased somewhat in size during the last year, but whether they represent metastatic growths or are the result of an old tuberculous process it is impossible at present to say. During November she developed very severe sciatic pains and pain in pelvis and back, accompanied by gradual loss of strength. She contin-

ued to grow worse and at present there is no doubt that she is suffering from metastases.

NOTE.—She failed rapidly and died January 12, 1913. A letter from her physician, Dr. Carleton B. McCulloch, stated that she had undoubtedly metastases in the lumbar and dorsal vertebræ.

CASE III.—*Myositis ossificans of the quadriceps extensor muscle*.—C. H., 16 years of age. Patient had always been well until the beginning of November, 1912, when, while playing football he received a severe blow in the left quadriceps muscle, which knocked him down. He did not notice anything until the next day when he found the leg very stiff and swollen, being one inch larger in circumference than the right; he could not bend the knee at all; there was no ecchymosis. Patient was referred to me by Dr. B. H. Whitbeck. Physical examination, December 19, 1912, shows a hard, bony swelling, fusiform in shape, occupying the anterior and middle portion of the left femur, most protuberant in its central portion, firmly fixed, measuring eight inches in length. The skin is normal in appearance and not adherent; motion at the knee is very greatly limited, extension normal, flexion very slight, not over 15° – 20° . The bony tumor seems to lie just beneath the skin and apparently involves the quadriceps muscle. Measurement over the most protuberant part of thigh, left: $17\frac{1}{2}$ in.; right: $16\frac{3}{8}$ in. There is no pain; walk somewhat unstable, the leg occasionally giving way; general health good. Examination of the X-ray photograph taken six weeks after the injury shows a fusiform tumor, apparently projecting about one inch beyond the periosteal border. The outline of the periosteum is distinctly marked; there are no indentations as ordinarily observed in sarcoma. In other words, the picture is almost identically the same as that shown in Case I. The photograph was taken by Dr. Byron C. Darling.

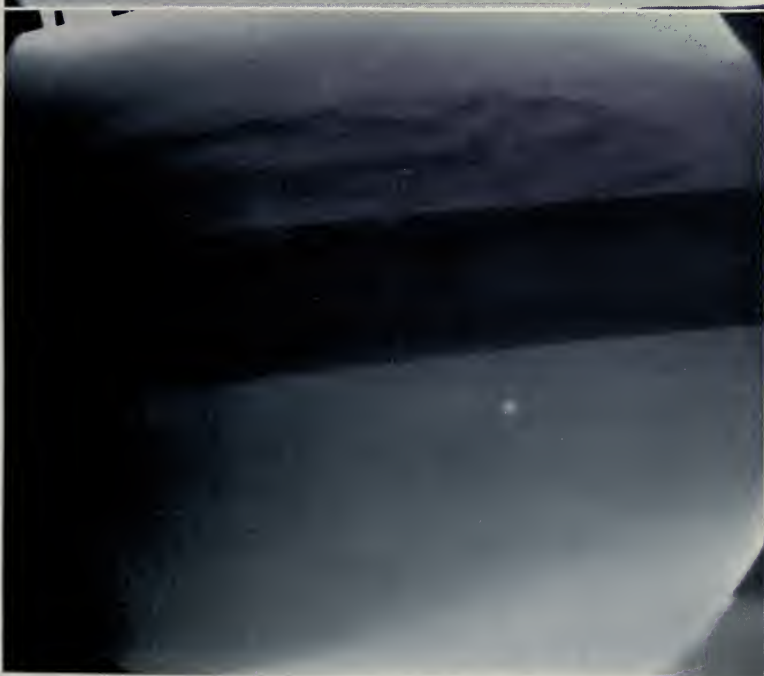
NOTE.—This case was observed the week following the reading of my paper and was kindly referred to me by Dr. Whitbeck, who made the diagnosis, having noticed its striking similarity to my cases just reported at the Surgical Society.

A careful study of 120 cases of sarcoma of the long bones, personally observed, has led me to the following conclusion:

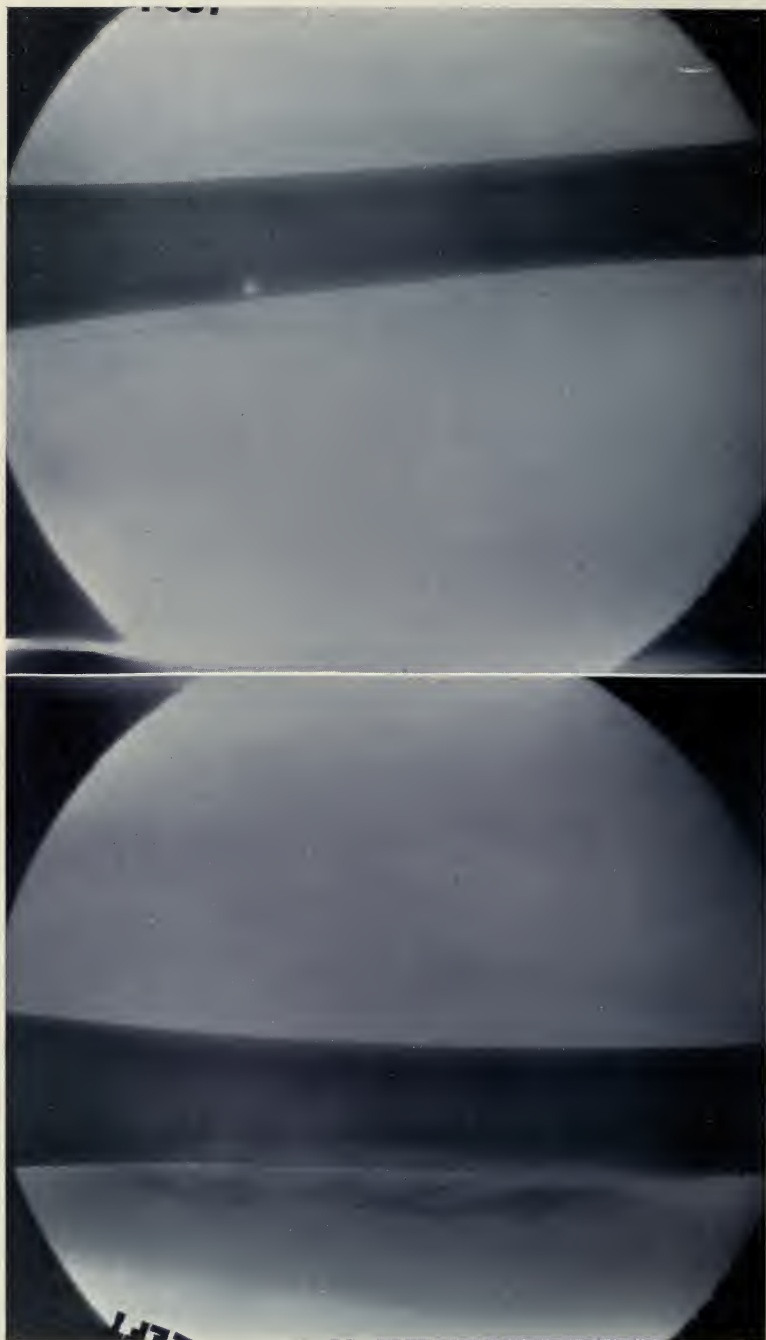
The diagnosis of sarcoma of the long bones in the majority



Sound femu (lat.-int. view). (Case III.)



Myositis ossificans, 6 weeks after injury (lat.-int. view). (Case III.)



Myositis ossificans. (Case III.)

Sound leg. (Case III.)

of cases can be correctly made from a careful clinical history of the case; a thorough clinical examination combined, if possible, with a good radiograph. In most cases it is wiser to do an exploratory operation and remove enough of the tumor for microscopical examination, in order to render the diagnosis beyond question. This is important—no matter what form of treatment be advocated. If the toxins of erysipelas and *Bacillus prodigiosus* are to be used before operation in the hope of avoiding an amputation, it is important that the nature of the tumor be settled beyond doubt, as it would be unwise to subject the patient to a long and none too agreeable course of toxin treatment if the disease were not sarcoma; and if it is sarcoma, and the patient recovers without the sacrifice of the limb, the value of the case from a scientific point of view is greatly enhanced if the diagnosis has been further confirmed by a microscopical examination. If amputation or even resection be the treatment decided upon, there is still stronger reason for having the diagnosis previously confirmed by microscopical examination.

Many objections have been raised against the wisdom of exploratory operations in malignant tumors in general, and particularly in sarcoma of the long bones. These objections have greater weight with English surgeons than with American. Some of these objections it must be granted are well taken, *e.g.*:

(1) The exploratory operation itself may cause grave risk, setting free, tumor cells in the circulation, thereby favoring general metastasis. While this result may possibly occur, long experience has shown it to be largely a theoretical objection rarely supported by clinical facts. A sufficient answer would be that the gain of having the diagnosis confirmed without question greatly outweighs the very slight and even problematical risk of general dissemination.

(2) Another objection and one that I think has more weight is, that the exploratory operation is often a very difficult one, especially in sarcoma of the lower end of the femur, particularly if situated posteriorly in the neighborhood

of the popliteal vessels. I have seen serious hemorrhages in several such cases, and in two cases found it very difficult to control them. However there is another objection which I consider of greater importance, and that is:

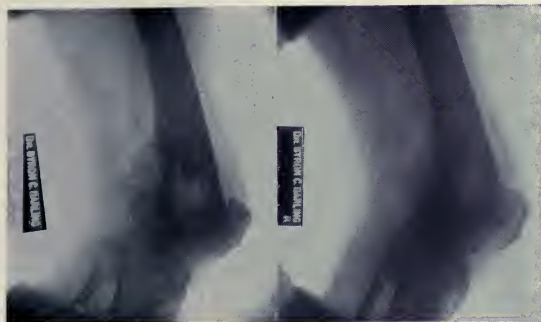
(3) The danger that such a deep wound may never heal; and if it does not heal it almost inevitably becomes infected, and the lack of good drainage may cause such severe septic intoxication, that amputation may have to be performed.

I will here cite two cases which well illustrate the dangers from exploratory operation in not easily accessible regions:

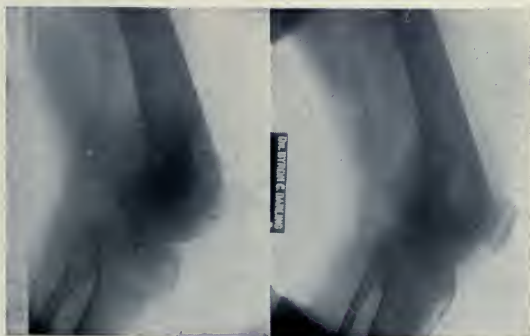
CASE IV.—*Central sarcoma of the femur, giant-celled type.*—A. J. M. C., male, aged forty-one years. Family history negative. Previous personal history unimportant. States that he had some pain in the knee in October, 1909. November 1 stumbled while going upstairs and injured right knee, which immediately became badly swollen and caused a good deal of pain; was treated as acute synovitis; unable to walk for a day or two. Under electrical treatment and massage for two weeks there was marked improvement, and he was able to walk without a cane. The swelling, however, never disappeared. In the spring of 1910, at the Massachusetts General Hospital he was operated upon, a $3\frac{1}{2}$ -inch exploratory incision over the internal aspect of the patella being made. No disease was found. Two days later an incision was made over the outer side of the patella and a tumor was found occupying the lower portion of the outer condyle. The wound was packed with iodoform gauze and bismuth paste; a sinus remained which never closed. His general condition remained good. The mixed toxins were started immediately after the operation. His weight increased from 190 pounds to 203 pounds. The first six injections with the toxins caused no reaction; the seventh produced a severe chill, followed by a temperature of 104° . After twelve injections, he returned home and had the treatment continued there. Two months later an X-ray plate was taken and as there was apparently some increase in size, amputation was strongly advised. Six weeks after this two other X-rays were taken and again amputation was strongly urged. The patient was brought to me by his brother, who is a physician, on January 23, 1911.



Interval, 3 months—March, 1911—June, 1911. Central sarcoma of femur controlled by the mixed toxins for nearly one year, *vid. text.* (Case IV.)



Interval, 6 months—March, 1911—September, 1911. (Case IV.)



Interval, 1 year 2 months—January, 1910—March, 1911. (Case IV.)

Examination at this time showed very slight enlargement of the lower end of the femur, chiefly in the region of the knee-joint; there was slight fluctuation in the joint and some redness of the skin. There was a scar about $3\frac{1}{2}$ inches long on the inner side of the knee, and an unhealthy looking sinus above the joint from which there was a profuse discharge of pus of a greenish tinge. There was a small enlargement of the lower end of the femur itself, most marked over the outer condyle. Measurements 9 inches above the patella are the same on both sides, showing that there is no atrophy of the muscles. I had an X-ray photograph made at this time, which, compared with the earlier photographs, showed little if any increase in size. In view of the previous diagnosis of sarcoma of the giant-celled type, it seemed to me unwise to amputate the leg without a more thorough trial with the toxins. The patient was sent to the General Memorial Hospital and a few days later, in order to establish better drainage, I made an incision over the old sinus and curetted out a considerable amount of tumor tissue, mixed with pus and bismuth paste. Microscopical examination showed it to be sarcoma of the giant-celled type. I found it extremely difficult to control the hemorrhage, and only succeeded by introducing gauze packing very tightly. A very severe attack of toxæmia followed, with a temperature of 104° – 105° . The patient was in a serious condition for two or three days. On recovering from this, I at once put him on the mixed toxins, beginning in small doses, and gradually working up to the point of getting a reaction of 102° – 103° . The wound was drained with a large tube. After a short time the patient's condition became normal; he was sent home and the treatment continued by his brother, with occasional intervals of rest. During the treatment, X-ray photographs were taken every four or five weeks to determine whether or not there was any increase in the growth; none could be made out and there was apparently a decrease of tumor tissue with substitution of normal bone (vid. illustration).

The patient's general health remained perfect in every way; he weighed more than he ever did; he went about comfortably with a cane; the sinus remained open, however. In the beginning of January, 1912, after about one year's treatment, a portion of the rubber tube became broken off in the wound, causing infection of the sinus followed by a severe attack of toxæmia.

His condition became so serious that in the mind of Dr. C. A. Porter of Boston and the other physicians attending him, it seemed necessary to amputate the leg in order to save his life. Examination of the tumor after operation showed little or no increase had taken place during the year of treatment.

I am just in receipt of a letter from Dr. C. A. McCarthy, the patient's brother, who states:

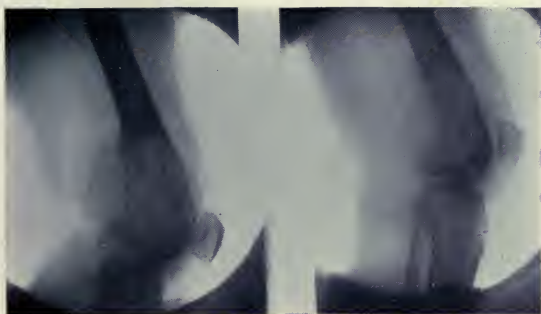
"My brother's health is excellent; he has an artificial limb and walks splendidly."

Specimen was examined by Dr. J. H. Wright, whose report reads:

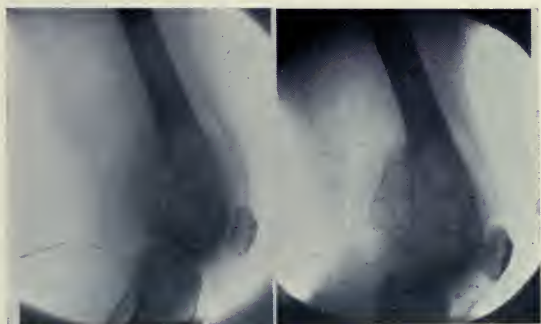
"Specimen consists of the lower half of the femur and some other adjacent parts. In the epiphysis is an irregular-shaped cavity of about the total volume of a small hen's egg. Partially bounding this cavity is a layer of white fibrous-like tissue 1 or more cm. thick in places, and attached to the cortical bone, and to the bone underlying the joint surface. At the upper extremity of the cavity and replacing the marrow of the shaft of the bone for a length of 3 or 4 cm. is a red, moderately firm tissue. This tissue is rather sharply demarcated from the layer of white fibrous-like tissue above described. Microscopical examination of sections from this red tissue shows a typical giant-cell sarcoma."

At almost the same time, another patient of about the same age, with exactly the same type of tumor, also in the right leg, came under my care:

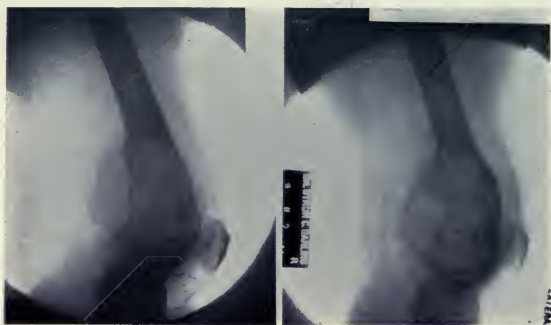
CASE V.—*Central sarcoma of the femur, giant-celled type.*—G. H. S., male, aged forty-seven years, resident of Detroit, Michigan. Family history negative. Personal history: three years before in the beginning of 1908, had fallen upon the ice injuring the lower end of the right femur. An X-ray was taken, and the bone was said to have been cracked. The condition was called by the surgeon a dislocation of the knee. One year later he had another fall; again the knee was said to have been dislocated. In February, 1910, he had a third fall, injuring the same knee. The swelling which had appeared shortly after the first injury had never subsided, and after the third injury began to increase rapidly in size. The series of X-rays taken within the preceding six months showed marked diminution in density of the lower three inches of the right femur and expansion of



Interval, 3 months—December, 1910—February, 1911. Central sarcoma of femur controlled by toxins for nearly one year, *vid. text.* (Case V.)



Interval, 1 month—February, 1911—March, 1911. (Case V.)



Interval, 4 months—February, 1911—June, 1911. (Case V.)



Interval, 1 year 1 month—February, 1911—March, 1912.
(Case V.)

the femur, with a sharply outlined, tumor-like formation, projecting about an inch beyond the normal outline of the bone. The tumor occupied chiefly the posterior or popliteal region of the femur, although the bone was enlarged in all directions; the joint was not involved. Various diagnoses had been made by a number of leading surgeons and X-ray experts. Nearly every one had given a different diagnosis. One of the most prominent surgeons of Chicago, who had seen it, believed it to be a cyst of the bone, non-malignant; another believed it malignant and advised amputation. My own diagnosis was, that it was unquestionably a sarcoma of central origin, probably giant-celled. On February 23, under ether anæsthesia, an incision six inches long was made over the inner condyle of the right femur, cutting down to the periosteum, pushing the vessels to one side in order to explore the popliteal region. A tumor about the size of a goose egg, apparently situated beneath the periosteum, was found. On opening this and passing through a thin shell of bone, a mass of partly broken-down, soft material was encountered, reddish-gray in color, and having the appearance of a vascular sarcoma; the finger passed into the cavity of the bone; the joint was not involved. Here again there was severe hemorrhage which it was found difficult to control. It was finally stopped by packing, as in the preceding case. Microscopical examination showed the tumor to be a sarcoma of the giant-celled type. The patient was immediately put upon the mixed toxins and remained under my care for two months, after which the treatment was carried out by Dr. J. W. Vaughan, of Detroit. The patient proved to be extremely susceptible to the toxins and was unable to take more than 3-4 minims, which were followed by severe reactions, the temperature rising in some instances, to 105° - 106° . At the end of four months' treatment his susceptibility had increased instead of diminished and he was unable to take more than 1-2 minims.

In this case, as in the preceding, a series of X-ray examinations were made every four or five weeks, and these were carefully compared with the pictures taken before the operation. Physical examination July 27, 1911, showed much less discharge from the sinus, which has persisted since the operation. Measurements over the middle of the patella showed a decrease of one inch, from $18\frac{1}{2}$ before operation to $17\frac{1}{2}$ now. January 5, 1912, I again examined the patient, and found his condition better than

at any time I had seen him; his weight had increased from 192 pounds in February, 1911, to 219 pounds. At this time the discharge had become very much diminished. The X-ray photograph taken the day before showed apparent diminution in size of the tumor with replacement of new bone; no extension of the disease could be made out in any direction; ability to use the leg better than before; general health perfect. The toxins were kept up in moderate doses, with occasional intervals of rest. In February, 1912, suddenly, while walking without any unusual exertion, spontaneous fracture occurred, with very profuse extravasation of blood into the surrounding soft parts, requiring almost immediate amputation. The patient recovered from the operation.

It might be concluded from these two cases that the use of the toxins preliminary to the amputation was an unwise procedure. Yet before forming an opinion one should consider the fact that there are now on record a comparatively large number of cases of sarcoma of the long bones, in which the use of the toxins has not only saved the life of the patient but the limb as well. I myself have had 9 patients, 4 of which I showed before the Clinical Congress of Surgeons of North America, November 14, 1912, well from five to fourteen years.

I believe had it not been for the exploratory incision and the consequent infection, that in all probability the sarcomatous disease would have been entirely controlled by the toxins, and the leg thereby, in one case at least, saved from an amputation. The X-ray photograph and subsequent operation by Dr. Porter in one case showed little if any increase in the size of the tumor during the year or more in which the toxins were used, and the general health of the patients remained perfect. Had the toxins not been used at all, amputation would have been performed $1\frac{1}{2}$ years earlier. I feel that had one been satisfied in these two cases with the probable diagnosis, instead of insisting upon an exploratory operation and microscopical examination, the patients' welfare, which should always be the primary consideration, would doubtless have been better served. Were I

again called upon, in a similar case, to decide the question of an exploratory operation, I am inclined to believe that I would not advise an exploration in a sarcoma so deeply situated and so difficult of access, in view of the dangers just described. I would trust to the clinical diagnosis confirmed by the X-ray examination and try the toxins for a brief period before amputation, and if no improvement was noted at the end of two to three weeks then decide upon an amputation or resection.

As a general rule I would not amputate a limb for sarcoma unless the clinical diagnosis had previously been confirmed by exploratory operation and a microscopical examination. Yet, there are important exceptions to this rule. I have amputated an arm at the shoulder-joint without any exploratory operation for a tumor the size of a closed fist, that had developed in three weeks. The dilated veins, general appearance and consistence of the tumor made me certain of the diagnosis. I have also amputated the leg for a very large sarcoma of the tibia and fibula; again, for a large sarcoma of the fibula. In addition I have twice performed total excision of the clavicle for sarcoma without previous microscopical examination to confirm the diagnosis. In all of these instances, the very rapid development of the tumor after trauma (within three weeks in three instances) and the clinical features characteristic of sarcoma, made the diagnosis absolutely clear. In these cases the dangers and disadvantages far outweighed the advantages of an exploratory operation, and justified immediate amputation without a microscopical diagnosis.

(4) Still another objection, and a very strong one, is that the tissues removed at the exploratory operation may not represent the typical structure of the tumor and, therefore, lead to a negative report on the part of the pathologists. The incision may not have been sufficiently deep and the portion removed may show evidence only of osteitis or productive inflammation, and the pathologist must give a negative report. In the face of such negative report, the surgeon feels it difficult

to determine the best course of action. The situation is well illustrated by the following case recently observed by the writer:

CASE VI.—Mrs. G. M., twenty-seven years of age; in May, 1912, first noticed pain in leg, which was treated for rheumatism for two months, without improvement. There was 14 pounds loss in weight. An X-ray was taken and on basis of same a diagnosis of periosteal sarcoma was made and immediate amputation was strongly urged, without any further examination. The patient was two months' pregnant, and in preparing for the amputation the uterus was emptied. Her husband was told that there was no possible alternative to amputation. The patient was referred to me on September 19, 1912. Examination at this time showed a hard, fusiform enlargement 7 by 8 inches in length, apparently of bony origin in the upper and middle thirds of the femur, gradually shading off into the normal outline of the bone. Largest circumference 19½ inches; skin normal; no enlarged veins.

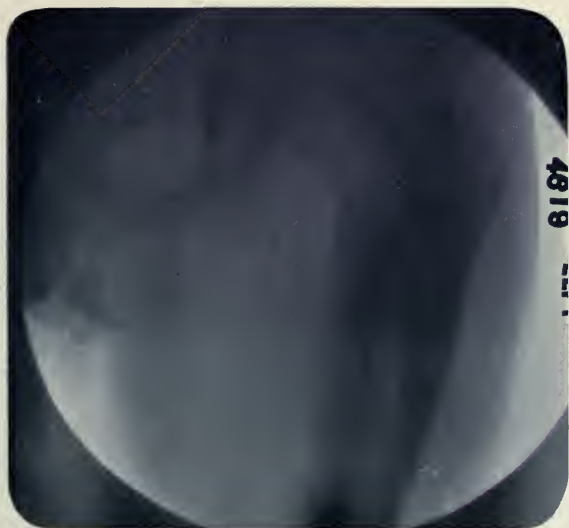
The patient entered the General Memorial Hospital and was put upon the mixed toxins. Wassermann examination of the blood proved negative. At the end of a week I made an exploratory incision in about the middle of the tumor, and on cutting down found a fusiform enlargement of the femur of the consistence of a periosteal sarcoma. The tumor extended about ½ inch beyond the normal line of the bone. A wedge-shaped portion was removed; there was no trace of any inflammatory exudate and no infiltration of the surrounding tissues. Clinically it had the typical appearance of a periosteal sarcoma, originating in the shaft of the bone, and the consistence and gross appearance of the specimen confirmed this view. The specimen was sent to Dr. Ewing, who reported as follows:

September 28, 1912: The tissue shows very little if any specific process and does not permit of a diagnosis. There is infiltration of the vessels with large round cells, suggesting sarcoma, but which might very well be tuberculous. I ought not to express any opinion on the data received and I would not amputate without further information.

On entrance to the hospital, the measurements over the upper, middle, and lower part of the cicatrix, representing the upper, middle, and lower end of the original tumor, were as follows:



Periosteal sarcoma of femur (clinical diagnosis), 2 months later. (Case VI.)



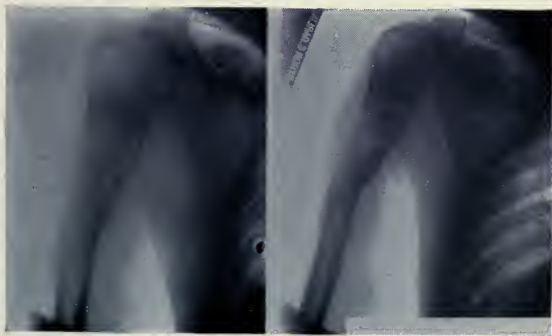
Sarcoma of femur mistaken for osteomyelitis. Death from lung metastasis three months later.



Periosteal sarcoma of femur (clinical diagnosis). (Case VI.)



Periosteal sarcoma of humerus—site of recent fracture. (June, 1910.) (Case VII.)



Sarcoma of humerus developing at site of recent fracture. Partial disappearance under toxin treatment. Interval, 5 months—July, 1910–December, 1910. Recurred December, 1910. Amputation shoulder-joint. Large recurrent tumor removed from pectoral region few months later. Patient in perfect health, February, 1913, nearly two years later. (Case VII.)



Osteoma of humerus. Differs both from sarcoma and myositis ossificans. (Case VIII.)



Osteomyelitis, humerus. Normal humerus. (Case IX.)



Sarcoma of fibula, periosteal. (Case X.)



Sarcoma of fibula, periosteal. (Case X.)



Sarcoma of fibula (amputation). Without preliminary microscopic examination. (Case XI.)



Osteitis, non-malignant. Exploratory operation. (Case XII.)



a *b*
a, bone cyst of tibia; *b*, normal tibia. (Case XIII.)



Periosteal sarcoma of femur. (Case XIV.)



Sarcoma of femur, periosteal. (Case XV.)



Sarcoma of radius, amputation 8 years ago. Toxin treatment after operation. Permanent cure. (Case XVI.)



Normal for comparison
Cured by the mixed toxins of erysipelas and B. prodigiosus
without amputation. (Case XVII.)

Sarcoma of radius.

Right, 16 in.; 18½ in.; 19½ in. Left, 15½ in.; 17½ in.; 18¼ in.

November 7, right, 14½ in.; 16½ in.; 17¾ in. Left, 14½ in.; 16¾ in.; 18 in.

November 26, right, 14¾ in.; 16¾ in.; 18¼ in.

The toxins were continued four to five times a week and the dose gradually increased from 0.5 minim to 6 minims. At the end of two weeks there was marked diminution in the circumference of the thigh. In view of the lack of certainty of Dr. Ewing's diagnosis and the rapid improvement under the toxin treatment, it was deemed very important to make a second exploratory incision, and on November 1 I made another incision ½ inch away from the first, 5 inches in length, and cut down upon the tumor. The latter was found considerably smaller in size, projecting only about ¼ inch from the shaft of the bone. An opening was chiseled into the central portion of the bone and several pieces of periosteal as well as central growth were removed and sent to Dr. Ewing. Clinically the tumor had every appearance of a partially necrotic sarcoma, a condition frequently seen as a result of the use of the toxins. Three X-ray photographs have been taken since by Drs. L. G. Cole and Holding, who believed the condition to be periosteal sarcoma. Dr. Ewing's report of the last specimen, dated November 1, 1912, reads:

Five sections from five different parts of the tissue received fail to show any signs of sarcoma. There is suppurative inflammation in an area lined with granulation tissue. The periosteum and bone show an active productive and rarefying osteitis. I find no signs of syphilis or tubercle. The condition suggests to me a pyogenic infection of the periosteum or osteomyelitis.

The clinical history and macroscopic appearance at the time of operation make it impossible to regard it as an osteomyelitis.

Subsequent History.—The tumor slowly subsided under the toxin treatment and at the end of six weeks the circumference of the thigh became nearly normal. The patient has had the toxins continued at home for the reason I did not believe it wise to place too implicit faith in a negative pathological report from small portions of material removed at an exploratory operation. She has gained 10 pounds in weight.

January 6, 1912, examination shows the tumor has been in-

creasing in size the last three weeks, but the general health is still good. I still believe the condition to be periosteal sarcoma.

NOTE.—February 16, 1913. Under larger and more frequent doses of the toxins the tumor is again decreasing in size.

Though we may never know the exact nature of the tumor in question, the conditions show very clearly the difficulties of diagnosis as well as of treatment. This case might be cited to prove the wisdom of not amputating a limb for sarcoma except the diagnosis be established beyond question.

On the other hand the case (Case II) that furnished the inspiration for the present paper, already described at length, might be said to prove the opposite contention, viz., that it would be wiser to operate on the clinical diagnosis alone, even in the face of a negative report of the pathologist. In said case we have a tumor of the femur of $2\frac{1}{2}$ years' duration, pronounced by a number of experienced clinicians as positively sarcoma, and an equal number of X-ray experts confirm this diagnosis. Believing it a possible case of myositis ossificans, I advised an exploratory operation, reserving the method of treatment to be decided by the result of the microscopical examination. The macroscopical appearance of the material removed was perfectly characteristic of new bone, in no way resembling sarcoma. The report of the pathologist was myositis ossificans, no trace of sarcoma. Two and a half years later, as shown by the history given, there seemed to be a slight increase in the size of the original tumor, which was confirmed by the X-ray. A second exploratory operation was determined upon and a much more extensive removal of the growth was made for microscopical examination. Again the structures showed myositis ossificans, and again on the strength of the report I refrained from a more radical operation, which later events proved would have been the wiser plan.

There are two theories which may be advanced in explanation of this most obscure case: First, that we were dealing with an original traumatic myositis ossificans which, after several years, degenerated and changed into an osteosarcoma.

In support of this theory may be cited the well-known fact that not infrequently benign tumors of the breast, cysts, cystadenomas or fibromas, do undergo malignant degeneration and become carcinoma. Likewise do chronic inflammatory conditions often undergo similar degeneration in course of time. Old fractures offer favorable sites for the development of sarcomata.

The second view is that soon after the accident a sarcoma developed in the bruised and strained portion of the periosteum, the sarcoma remaining of very slow growth and almost latent for nearly six years, and then suddenly, and possibly aggravated by the trauma of the second exploratory operation, lighted up and grew with great rapidity.

Dr. Ewing accepts the latter view as the true one, and believes that the careful microscopical examination gives evidence of its correctness.

I incline to believe the first view, namely, that the sarcoma was of comparatively recent origin, developing from the site of an old myositis ossificans, to be more in accord with the clinical history and known facts. If the tumor was sarcoma from the first, then it was sarcoma at the time of my first exploratory operation, nearly three years later. The specimen removed was not superficial, but extended down fully an inch into the growth and was carefully removed with a chisel. Clinically it had every appearance of new bone; it was absolutely unlike sarcomatous tissue. Microscopical examination by Dr. Ewing himself failed to show any trace of sarcoma. Again, $2\frac{1}{2}$ years later, the clinical appearance was the same, except for the very slight increase in size. The second exploration was far more extensive than the first, and a large amount of the growth covering an area of 3 inches in circumference and $1\frac{1}{2}$ inches in depth was chiseled and cut away. This material was macroscopically precisely the same as at the first operation, and was again regarded as myositis ossificans by Dr. Ewing. It is true, there were some cells of peculiar type found at the second operation which he could not fully explain, and which in the light of later evidence were probably cells beginning to undergo sarcomatous

changes. The complete and rapid change in the clinical appearance of the tumor two months later would seem to show a corresponding change in its real nature. This was further confirmed by the microscopical examination of the tissues removed at this time.

If we accept Dr. Ewing's view, and his opinion is entitled to more weight than my own, we are forced to the unwelcome conclusion that we can place very little reliance upon the pathologist's report of a specimen removed by an exploratory operation in tumors of the long bones.

In my first case, the negative report of the pathologist saved the patient from an amputation which otherwise would have been performed. In the second case, the negative report prevented an amputation which would otherwise have been done three years ago, with a greater prospect of saving the life of the patient. No matter how we interpret these two cases, we are forced to conclude that the diagnosis of tumors of the long bones is extremely difficult and in certain cases, though happily rare, it may be impossible, even with the advantage of every known aid, to make a diagnosis early enough to save the life of the patient.

The only type of sarcoma which could simulate the condition found on amputation, is the type designated by Gross as osteoid sarcoma, and it must be admitted that there is some similarity. He describes one case in which the ossified portion of the growth proved a huge mass which looked like spongy bone, and another, in which the appearance was that of dense ivory-like bone. Yet, the history of these very cases cited by Gross, makes it difficult to accept Ewing's theory that the case in question was sarcoma from the beginning. Gross collected 45 cases of the osteoid type of sarcoma, and from a study of these cases, he concludes that "not only are osteoid sarcomas locally infectious, but they are next to the pure periosteal spindle-celled, the most malignant of all the neoplasms of the osseous system, since 65.62 per cent. of all cases died of metastasis." In other words, this type of tumor is extremely malignant, and that means a short duration of

life. In fact, in the seven cases which ended in death, without surgical interference, the average duration of life was 16 months, so that it would seem extremely improbable that the tumor in my own case—which had existed for nearly six years before it began to affect the general health of the patient—should have been of this type. Furthermore, in my own experience, based upon a personal observation of 125 cases of sarcoma of the long bones, I have never seen a case of six years' duration, or even three years' duration, without operation.

MYOSITIS OSSIFICANS.—There are three well-recognized types of myositis ossificans which have been described from time to time and which have been receiving more and more attention since the introduction of the X-ray made it possible to study them more accurately.

The first type, known as myositis ossificans progressiva, goes on involving one muscle or group of muscles after another until all the muscles of the body are involved. It usually starts in the trapezius muscle or latissimus dorsi.

The second type is single instead of multiple, and is the result of some chronic irritation or of a series of traumas, instead of a single trauma, well illustrated by the simple osseous formation that occurs in certain muscles so situated as to be liable to irritation or injury, *e.g.*, the pectoral muscle in soldiers, as a result of the kicking of the musket. (Hassen found 18 osteomas in 600 conscripts.) Again, this type is found in the muscles of the calf of the leg in cavalrymen and the heel of dancers.

The third and rarer variety is the one with which we are dealing in the present paper, and one seldom recognized before the admirable papers of Binnie (*ANNALS OF SURG.*, Sept., 1903) and Robert Jones (*Arch. of the Röntgen Ray and Allied Phenomena*, 1905–1906). Binnie reported a most interesting personal case and collected all the other cases he was able to find in the literature up to that time. Cahier (*Rev. de Chir.*, 1904) collected 257 cases of myositis ossificans

traumatica, including the second and third varieties, but not the progressive type.

Most statistics, up to the time of Strauss, grouped together, under the general head of myositis ossificans traumatica three or four different conditions. The term should properly apply only to those resulting from a single trauma. It is interesting to know that Strauss collected 127 such cases. Of these 43 occurred in the quadriceps femoris, 13 in the adductors of the thigh, 64 in the flexors of the upper arm; the remainder were scattered over various muscles of the body. The best papers in recent years are that of Finney (*Transaction of the Southern Surgical Society*, 1909), and that of Lapointe (*Revue de Chirurgie*, Nov., 1912).

Finney reported six cases, three observed by himself, three others seen in consultation, four occurred in football players; one came to operation; all recovered.

To emphasize the point which I shall discuss more fully later, that the disease may closely simulate sarcoma, it is stated that the diagnosis of subperiosteal sarcoma had been made in all three of Finney's cases. One case, operated upon twice, recurred, necessitating three operations. Amputation at the hip-joint had been recommended and was about to be performed in one case, when first seen by Finney. In another case quoted by Finney (Whitelock) amputation of the thigh was performed under the mistaken idea that the condition was a periosteal sarcoma.

Finney states that males are almost invariably the subjects of this affection, only two cases in woman having been thus far reported. This is probably explained by the fact that men are much more liable to severe injuries, which are the exciting causes. The disease is much more common since the introduction of football. Of Finney's cases two were due to the kick of a horse, four to injuries received while playing football.

The most recent and elaborate study of the pathology and treatment of myositis ossificans, or "myostéomes traumatiques" as the French characterizes the disease, is that of

Lapointe, published in the *Rev. de Chir.*, in November, 1912. Lapointe reports one case of his own, of the quadriceps extensor, very closely resembling my own cases and that of Mr. Makins. This case occurred in a man twenty-one years of age who attributed the trouble to a fall three weeks before. A tumor apparently springing from the anterior and middle portion of the femur, 17 cm. in length, had developed within the short period of 24 days after the injury. Extension was normal, flexion markedly limited. An interesting feature which I have not noted in other cases, was a temperature of 99° – 100° . Lapointe states that he made a grave error in diagnosis. The very close fusion with the diaphysis of the femur, the slight dilatation of the superficial veins, the temperature, all seemed typical of a periosteal sarcoma. The radiograph which should have corrected the error only emphasized it by reason of the use of an imperfect plate. The radiographer took a second plate which gave an identical result. Before proposing to the patient such a mutilating operation as amputation at the hip-joint, he decided to wait a short time. In 15 days the supposed sarcoma, instead of increasing in size, had diminished. Another radiograph, taken a month later, showed the same characteristic appearance of myositis ossificans as I have observed in my own cases. Lapointe operated on May 26, 1911, 66 days after the injury, and removed an elliptiform tumor $17 \times 5 \times 3$ cm. Muscular fibres completely surrounded it except at its point of attachment to the femur over an area 6 cm. long and 2 cm. broad. A fragment of periosteum detached from the femur adhered to the internal aspect of the osteoma. The patient made a good recovery, but had a slight recurrence four months later.

Robert Jones, in 1905, gave a brief history of 15 cases of the third variety personally observed, and a résumé of most of the cases collected by Cahier and Binnie. Most of Jones's cases occurred in the vicinity of joints. In only two of Jones's cases was there a microscopical examination made and the pathologist's report (Dr. Dimond, hospital pathologist) reads as follows: "In the first case the bone generally is of

the cancellous type and at the edge of the bone the muscle seems to have been sprinkled with numerous small foci, around which the bony matter has been deposited; generally the centre of these foci contains a small branched cell (osteoblast). The bony matter is deposited along the muscle-fibres and at parts of the specimen the striation of the muscle is still visible. The condition is a true ossification, not calcification."

In the second case he reports: "The general shape of the bone was that of a V. There were no signs of any periosteum whatsoever. There were numerous foramina over the whole bone, into many of which passed small tendinous extensions from the surrounding muscle, and into others passed small blood-vessels which communicated directly with the cancellous spaces throughout the mass of bone. The general structure was that of soft or cancellous bone, the spaces being fairly large and occupied by blood-corpuscles and a few giant-cells, etc."

These two cases show a structure strikingly similar, both macroscopically and microscopically, to that observed in my own two cases. The clinical history in Jones's and the collected cases was much the same. We have the history of an antecedent blow or injury and the subsequent development of a hard tumor a few weeks or months, or in some cases years, thereafter.

In none of the cases thus far reported has there been a history of transformation or degeneration of the bony tumor into a sarcoma or malignant growth. Yet it would be impossible to state that such a result never occurred in these cases, inasmuch as they are nearly all lacking in the very important detail of after-history. Makins' two cases published in the *Transactions of the Royal Soc. of Med.*, Surg. Section, 1911, are an important exception. In both cases an X-ray was shown of the original condition and the condition six years later.

Etiology.—The question of the etiology of traumatic myositis ossificans has already been fully discussed by Binnie

and Robert Jones, and therefore I will not go into it at length, but will merely mention the various theories propounded.

The first theory was, that the blood which extravasated at the time of the injury later became transformed into bone. Our increased knowledge of pathology has made such a theory untenable.

Another theory is that advanced by Cahn, and based upon the assumed correctness of Conheim's theory of tumor development. It presupposes aberrant embryonic cells in various parts of the body and has little to support it.

The third theory is that at the time of the injury, a portion of periosteum becomes detached and from these fragments of periosteum result the bone formations in the muscles and fascia. In other words, that they are in the nature of bone grafts.

Ziegler and other pathologists of more recent times believe that the process is one closely related to tumor formation.

Binnie states: "It will be noticed that in my case ossification is as far advanced in the distal as in the proximal portions, that around and throughout the tumor there is great proliferation of the intramuscular connective tissue, that ossification is both of the fibrous and cartilaginous type, and that muscle-fibres in every stage of degeneration are scattered here, there, and everywhere, lying in the connective tissue, in among the islands of cartilage, and hugged by the trabeculæ of bone. There is no microscopical evidence of any inflammatory changes. If this case is one of purely periosteal origin, then the scattering of the periosteal cells or grafts must have been through a territory extraordinary in length and in latitude wonderfully limited. Its origin from a separated periosteal flap is simply inconceivable in view of its relations to the innumerable discrete and degenerating muscular fibres. From careful examination of even this one case, one is forced to admit the possibility and probability of the bone tumor being the result of proliferation and metamorphosis of the intramuscular connective tissue."

Robert Jones believes that in the majority of cases the

growth springs from the periosteum. He bases his conclusions "largely upon the frequency with which these growths are associated with dislocation; their frequent attachment to bone; their frequent growth between the bone and muscle, and sometimes their attachment below the muscle origin, which has been subjected to a violent strain; that in fractures shreds of periosteum may give rise to the development of bone apart from the callus and reparative processes." Jones states that in nine-tenths of the cases the tumor formation is marked in the first two months, the majority by the end of the first month. The recent researches of Macewen upon the growth of bone give rise to some doubt as to the periosteum's being the sole cause of the new bone.

After a very full discussion of the various theories as to the etiology of myositis ossificans, Lapointe states that in his opinion "the theory of an ossifying myosteoma is tenable both for the adhering myosteomas and for the free ones. It can be seen that the insertion into the skeleton is the only point which distinguishes them. All of their other characteristics, both microscopical and macroscopical, are the same. No difference in the method of their development or in their structure has ever been found. The cartilaginous ossificans that has been considered as a type of periosteal osteogenesis is found also in the medullary osteogenesis, so, why should we maintain that the tendinous insertion of a muscle, which is an incontestable factor in the formation of free myosteomas, has not to do with the formation of adherent myosteomas? Is the implantation or non-implantation enough to justify two different pathogenic theories?"

Gillet, in his Thesis of Paris (1910), discusses at some length the difference between myosteomas (myositis ossificans) and true neoplasms. He states the fact that the former not infrequently recur does not constitute them neoplasms, although some writers take the opposite view. A true neoplasm is capable of not only local return but of general metastases, a quality which the tumor in myositis ossificans

does not possess, there being no case on record so far of other than a local return.

He believes that whatever the anatomical considerations, clinically osteomas should never be classed as tumors, and states that, in the first place, we are able to reassure the patient and his family as regards any fears of a tumor. Whatever the variety of osteoma, it is always benign without tendency to increase indefinitely or to generalize, and never is transformed into a malignant process.

This statement of Gillet's was probably true at the time it was written, though the evidence here presented may lead to some qualification in the future.

Diagnosis.—Various conditions may simulate myositis ossificans, particularly in the early stages, *e.g.*, contusion, hæmatoma, myositis, periostitis, periarthrititis, syphilitic tumors; but all of these conditions can be differentiated by means of a careful examination aided with a good radiograph.

In periostitis and osteomyelitis, we usually have elevation of temperature, local tenderness, severe pain which is worse at night. Myositis is prone to develop in certain muscles which are seldom the site of syphilitic disease, and the Wassermann test will furnish an additional aid in differentiating the conditions.

On the other hand, the age of the patients (usually young adults) and the fact that the tumor developed shortly after an injury furnish a history almost identical to that observed in sarcoma. In many cases, too, there is a striking similarity in the X-ray picture between the two diseases. In my first case, the X-ray plates had been examined by at least half a dozen X-ray experts and all pronounced the lesion sarcoma. Careful examination, however, of the radiographs which I have been able to observe personally shows this important difference:

In myositis ossificans the sharp outline, corresponding to the junction of the tumor with the bone, is always present, while in sarcoma it is less distinct except in the very early stages of the disease. It was this feature which influenced me

chiefly in making the diagnosis of myositis ossificans in the first case. In the second case the same clear line of differentiation is observed in the earlier picture, although it is not so distinct in the later. I have seen but one case of periosteal sarcoma in which this was not true, and this happened to be a case of extremely rapid growth, apparently sarcoma, in a young adult, a woman of nineteen. The X-ray photograph taken about a month after the beginning of the tumor showed a clear line without any roughness or indentations, which could easily be mistaken for myositis ossificans. In this case, however, there was the absence of a severe injury which is almost always the exciting cause in myositis ossificans, which furnished an important aid in making the diagnosis.

A further and very important point which I have not seen noted in other articles is the marked difference in the consistence of the tumors as determined by palpation. In myositis ossificans the consistence is much harder than in sarcoma; furthermore, it is almost always uniform in character, whereas in sarcoma it is very apt to be soft in some places and harder in others, but there is never the bony hardness that is typical of myositis ossificans.

The pain is another important differential symptom. In sarcoma there is rarely pain in the early stages, unless the tumor is situated near some important nerve, whereas in myositis ossificans pain is much more apt to be a feature in the early development of the disease. Furthermore, the early disability of the neighboring joint, as usually observed in myositis ossificans, has been seldom noted in sarcoma in the early stages. Flexion of the knee is almost lost or greatly limited, and this may occur very soon, a few days after the injury, in myositis ossificans.

The clinical history together with the characteristic features already enumerated will, in most cases, enable one to render a correct diagnosis of myositis ossificans; yet the great importance of making an early and absolutely certain differentiation from sarcoma, in my own opinion, justifies an early exploratory operation and removal of sufficient ma-

terial for a microscopical examination. This is especially true if the tumor is located along the shaft of the bone and not in the neighborhood of a joint. In case the patient is unwilling to submit to an exploratory operation, very careful and frequent observations will soon determine the true character of the disease. If it is sarcoma, there will be steady and fairly rapid increase in size, if myositis ossificans, but very slow increase in size, if any, is noted.

Treatment.—The question of treatment is an extremely important one. Yet the data at the present time would seem hardly sufficient to warrant the laying down of any absolute rule. Jones states that "if we operate early, we risk leaving histological elements behind. If we operate late, apart from the greater destruction of tissue, the proceeding is sometimes very difficult. With our limited experience we would suggest early operation, feeling it would be wiser to risk the performance of a second operation in an endeavor to prevent the spread of trouble, than to delay operative interference, which might result in exuberant development of bone."

Jones, however, in a letter to Mr. Godlee (*Trans. Royal Soc. of Med.*, Surg. Section, 1911), admits that further experience led him to considerably modify his original opinion as regards treatment. In this letter he states: "Since writing the article I have come upon cases where the deposits, instead of increasing, have decreased, and I am not now at all convinced of the value of operation. The simplest looking mass in the bend of the elbow is a very difficult problem to negotiate operatively, and I have on more than one occasion wished I had left the whole thing alone."

A careful review of the cases thus far recorded would lead one to conclude that no single method of treatment is applicable to all cases. The two very interesting and most typical cases, carefully reported by Makins (*Trans. Royal Soc. of Med.*, 1911, p. 132) furnish further strong ground for first trying conservative treatment. These two cases, as shown by the history and radiographs, are almost identical with my first case. Makins's cases were both young adults;

in both the disease occurred in the quadriceps muscle, one followed a football injury, the other the kick of a horse. In both cases he was able to show radiographs taken six years after the original injury, demonstrating almost complete resorption of the bony tumor.

With regard to treatment, Makins states: "As to the general line of treatment to be adopted, a period of some weeks' complete rest should be maintained during the continuance of the active progress of ossification. When it is judged by clinical observation and X-ray examination that progress has ceased, or the process is retrogressive, massage and exercise should follow. Operative treatment should only be considered when the process has manifestly come to a definite standstill, and the patient suffers from functional disability which there is a chance of relieving."

Godlee's case (*l.c.*) still further shows the advantages of conservative treatment. Godlee stated that Mr. Clutton operated upon two similar cases in which the operation had done harm, and he strongly urges "the advisability of leaving these swellings alone until ample time has been allowed, at least a year for the absorption of what may be called provisional callus. Even after this time, I think that removal would only be justified if the mass were causing mechanical inconvenience and pain. It must be remembered that the operation is inflicting another traumatism upon a part, which for some reason has shown a special tendency to the development of bone, and it cannot therefore be surprising if renewed activity of the process should follow."

Some advise early incision and evacuation of the extravasated blood, but this is of doubtful expediency and not to be recommended. Massage is, likewise, inadvisable.

Finney has this to say as regards treatment: "There is an unfavorable as well as a favorable time for operation. It should never be recommended early in the development of the bony tumor, even for diagnostic purposes, since, if we have to deal with a subperiosteal sarcoma, it is of doubtful efficacy, and in this condition the tendency to recur at this stage is very great. If the operation is performed when increase in the size

of the tumor is no longer present and its consistency has become harder, the chances of a recurrence are very materially lessened. The operation should consist in a thorough excision with ample margin of all the osteoid tissue, including some healthy muscle. The underlying periosteum should be thoroughly excised and the shaft of the bone cleaned off until a smooth surface remains. Cauterization with the actual cautery of the denuded bone surface has been recommended. Operation is not recommended in every case; many of them recover under rest and later massage and active and passive motion."

I cannot agree with Finney in advising against exploratory operation for diagnostic purposes. He states that, if we have to deal with a subperiosteal sarcoma, it is of doubtful efficacy. This advice is evidently based on the generally accepted belief that subperiosteal sarcoma is an entirely hopeless condition. Yet we now have a rapidly increasing number of cases of subperiosteal sarcoma which have been cured (and are well over three years) either by the mixed toxins of erysipelas and *Bacillus prodigiosus*, alone, or by the toxins combined with operative treatment. One such case I have the pleasure of showing this evening. This case, a round-celled subperiosteal sarcoma of the femur with extensive multiple metastases, recovered under the toxins and remained well over ten years. A full report of this case will appear in a later number of the ANNALS OF SURGERY. Another important case in point is the case of Williamson (*Transactions of N. Dakota Med. Soc.*, 1910), periosteal round-celled sarcoma, confirmed by microscopical examination by the pathologist of the State Laboratory, and pronounced too far advanced for hip-joint amputation by Dr. W. J. Mayo, who advised the mixed toxins. The patient entirely recovered, with a normally useful leg, and is now well 3½ years later. I do not believe that the small exploratory incision with removal of sufficient material for diagnosis, does any harm in either condition in ordinary cases, and may be of the greatest value in enabling the surgeon to at once advise the proper method of treatment.

In laying down any general rules for the treatment of myositis ossificans, I believe with Lapointe, that sharp distinction should be drawn between the two classes of myositis ossificans, *i.e.*, the cases occurring along the diaphysis of the bone and those situated in the neighborhood of a joint. The latter cases are often complicated with ossifying periarthrititis which greatly affects the operative prognosis. While in a number of the cases recorded in the literature there has been a true recurrence after operation, in no case has the size of the recurrence reached that of the original tumor. Lapointe was able to find only 2 cases that had been re-operated upon after recurrence, the cases of Hoffmann (*D. Militär-ärztl. Zeitschr.*, 1902, vol. xxxi) and Patry (*Soc. méd. de Genève*, 28 janvier, 1909). In the case of Patry there were three successive operations at intervals of a few weeks. The third recurrence was not operated upon, but finally disappeared and the patient fully recovered the function of the extremity.

The thesis of Chabrol (Contribution à l'étude des ostéomes musculaires, etc., *Thèse de Paris*, juillet, 1912) gives the latest facts bearing upon the end results of operation. In 95 cases which he collected there was complete restoration of function in 77; improvement was noted in 15, and no improvement in 3 cases.

In the cases in which the lesion occurred in the neighborhood of a joint, in which there was more or less coexistent ossifying periarthrititis, the results were not as good. Chabrol found 25 cases of extirpation of the anterior brachial muscle after dislocation, with complete restoration of function in 8, improvement in 8, and no improvement in 9.

Lapointe's conclusions as regards treatment are that prophylactic measures are uncertain; the value of conservative treatment is more apparent than real and explains the spontaneous regression of the ossifying process which, in time, often results in complete restoration of function. He believes that extirpation six or eight weeks after the trauma is the method of choice in cases not complicated with ossifying

periarthrititis. In some of these, the more severe cases, resection may be advisable.

NOTE.—I desire to express my great indebtedness to Dr. Byron C. Darling, not only for his very excellent radiographs but also for his valuable help in preparing and arranging the illustrations.

I further wish to express my appreciation of Dr. James Ewing's hearty coöperation in the matter of pathological reports and microphotographs.

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SUB-TEMPORAL MUSCLE DRAINAGE BY THE AID OF SILVER WIRE DRAINAGE MATS IN CASES OF CONGENITAL HYDROCEPHALUS.

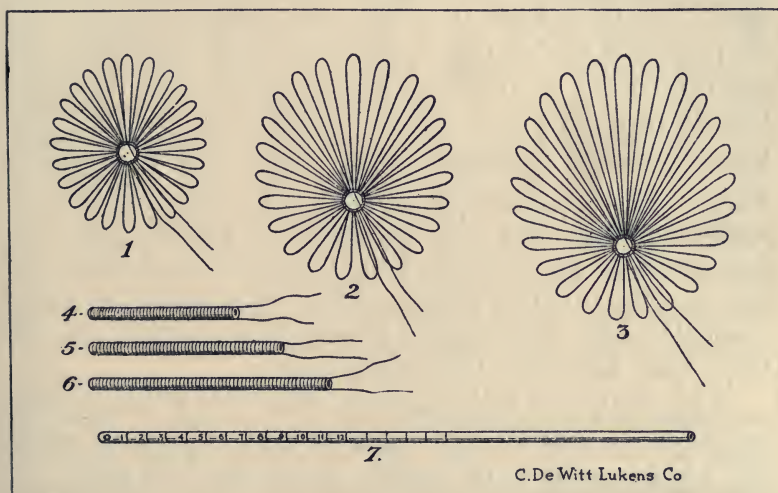
BY WILLIAM H. HUDSON, M.D.

OF ATLANTA, GA.

IN cases of congenital hydrocephalus where drainage underneath the scalp is attempted the writer has found a vast additional drainage capacity by using the under surface of the temporal muscle for the absorption surface by inserting under this muscle silver wire drainage mats. Where this is to be attempted the operation should be done in the following manner: The usual point for perforating the skull dura and brain, posterior and above the right ear is selected. An incision about two and one-half inches long, with its curve in a backward direction, is made down to the temporal muscle. A point about an inch in front of the curved incision is selected, and the fibres of the temporal muscle separated at this point. A flat separator with its point hugging the bone closely is pushed in every direction to its line of insertion under the entire skull area of the temporal muscle. Then the skull is opened with a self-stopping spiral perforator, its bottom cleared with the smallest size self-stopping burr. The dura is then split the full extent of opening in the skull. The two edges of the dura are then caught with mosquito forceps and the incision held open as far as possible. Through this opening a long, dull-pointed ventricular puncturing tube is inserted into the brain until the cerebrospinal fluid flows from its open end. The depth is read off on the side of the tube, which is marked in quarter inches. The permanent drainage tube is then cut to its proper measured length, and then slipped over the puncturing tube and carefully rotated to its proper permanent location in the brain, the two lateral fixation wires being carefully preserved. The silver drainage mat, which was fixed under the temporal muscle immediately after the muscle was separated

from the bone, is now fixed in position, and the fixation wires of the permanent tube carefully twisted around the central ring of the drainage mat. The temporal muscle is then carefully sewed over the mat and tube with the finest possible black silk. The incision in the scalp is also closed with the finest possible black silk. This operation must be done under the strictest aseptic precautions, with the use of new rubber gloves and the most careful sterilization of the patient's scalp.

FIG. 1.



1, 2, 3, silver wire drainage mats of different sizes. The fixation rings should be shown nearer the edge of the mats. 4, 5, 6, permanent drainage tubes of coiled silver wire of different lengths with fixation wires. 7, brain puncturing tube with dull round end, marked in quarter inch lines. The opposite end should be marked in the same manner beginning with 1, so that this end could be used as a measure for the permanent drainage tubes. The puncturing tube should not be removed until the drainage tube is properly placed.

A loose dressing finished with plaster-of-Paris bandages should be applied in such manner that no direct pressure is applied over the operation wound or the temporal region of the operated side. The greatest possible accuracy and delicacy of operative procedure should be observed.

In Fig. 1 are shown three sizes of the drainage mats, three lengths of permanent drainage tubes, and one puncturing tube marked at its puncturing end in one-quarter inches. The other end should be marked in the same manner so that that end may be used for measuring the permanent drainage tube before it

is cut. The permanent drainage tubes, as shown here, are made of coiled silver wire. It is possible they would be better if made of the thinnest gold, or silver, or platinum plate, with the fixation wires soldered to the ends of these tubes. Generally it would be necessary to cut them at the time of use. Cutting these thin tubes with a pair of scissors makes sharp corners which may cut the cortical vessels when the tubes are inserted. So, if solid tubes are used, it is best to cut them with a sterilized file, cutting through the wall of the tube its entire circumference. The tubes made of coiled silver wire can be cut with the point of a pair of scissors without constricting them. All that is necessary is to cut the wire at one point after the lateral holding wires have been cut. In inserting the mat under the temporal muscle a spooned brain spatula should be pushed well under the temporal muscle. If any difficulty is encountered the silver wire loop should be pushed home carefully and accurately with the point of a silver probe which has been notched for this purpose. The mats should be placed smoothly under the temporal muscle, being careful that the loops reach well down toward the zygoma.

Two small drill holes made on either side of the trephine opening in the skull through which the fixation wires are passed will add somewhat to the stability of the mats and tubes.

THE THYROGENIC ORIGIN OF BASEDOW'S DISEASE.

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It is now about twenty-five years since Moebius emphasized the importance of the thyroid gland in Basedow's disease and advanced the theory that in the hyper-activity of the gland we find the cause of the symptom-complex which is generally known as Basedow's disease. It was in 1887 that Moebius published his classical treatise upon this subject. The treatment of this disease since that time has for the most part been based upon this hypothesis, and remedies both medical and surgical have been employed which were designed to check the activity and thereby diminish the secretion of the thyroid gland. So general has this hypothesis become that the thyroid origin of Basedow's disease has been practically accepted by the medical profession the world over.

While from a clinical, and we might perhaps say also from an experimental, standpoint the thyroid origin of the symptoms of this disease seems well established, yet there are many problems still to be solved. The primary cause of the thyroid change is as yet unknown, while much confusion and contradictory evidence exists throughout the literature, especially relating to the questions of hyper- and dis-thyroidism as the essential elements in the disease.

Marine and Lenhart ¹ have written extensively against the present conception of this disease and endeavored to show, through experimental observations made by themselves as well as the observations of others, that the Moebius theory has never been proved and therefore the present methods of treating Basedow's disease are not based upon a proper foundation. Marine and Lenhart have come to the conclusion that the thyroid changes are not the cause of the symptoms of the disease, but that the involvement of this gland is only a part of a general disease and is therefore only symptomatic; that the

only disturbance of the thyroid in this disease is that of functional insufficiency, while its reaction is only compensatory.

Marine of Cleveland, before the Surgical Section of the American Medical Association, at its recent meeting in Atlantic City, again reviewed the experimental evidences for and against the hyperthyroidism theory of Basedow's disease, giving the same conclusions as before, mainly that the hypothesis of Moebius was as yet to be proved.

C. F. Hoover² bases his views upon the investigations of Marine and Lenhart, and seriously questions the present surgical treatment of Basedow's disease. Hoover is of the opinion that the disease is not of thyrogenic origin, and that the good results obtained from the surgical treatment cannot be explained upon the basis of hyperthyroidism.

It is interesting, from a practical surgical standpoint, to note the opinions expressed by those who are opposed to the thyrogenic origin of the disease in explanation of the good results following its surgical treatment; such results are explained as being due to the rest in bed, psychic causes, suggestions, or, as Carlson (3, p. 130) says, that they are perhaps "instances of spontaneous recovery."

The arguments usually given for dissenting opinions against the Moebius theory may be grouped as follows:

First.—The unknown factor or cause of the increased activity of the gland.

Second.—The failure of both medical and surgical treatment to cure all cases of Basedow's disease.

Third.—The occasional spontaneous cures which result from other forms of treatment, such as rest, nerve sedatives, etc.

Fourth.—The apparent inability to reproduce the disease experimentally in lower animals.

Fifth.—The refutation and rejection of published experiments in which the disease has been produced in lower animals.

Sixth.—Ascribing the cure to some other factor after surgical treatment rather than to the operation itself; such as the relief of pressure, rest in bed, psychic treatment, etc.

It is the purpose of this paper to review the chief clinical

and experimental evidences in favor of the thyroid origin of the symptoms of Basedow's disease as a justification of the present surgical methods in its treatment. It seems to me that sufficient time has now elapsed to have tested the thyroid theory to such an extent, at least from a clinical standpoint, that we particularly as surgeons feel warranted in claiming that in the thyroid gland we find the chief cause of the symptoms of exophthalmic goitre.

EXPERIMENTAL HYPER-THYROIDISM AND BASEDOW'S DISEASE.

CARLSON,³ in a most excellent article, reviews the attempts to produce the experimental hyper-thyroidism in animals and birds, and adds some very interesting experiments of his own. His work is particularly directed to the refutation of the theory of hyper-thyroidism. He states that the prevalent view regarding the etiology of exophthalmic goitre is based upon "(1) the structural changes in the thyroids, (2) the effects of partial extirpation of the gland, (3) the aggravation of the symptoms by thyroid administration, (4) and the alleged production of some or all of the symptoms in healthy individuals and experimental animals by thyroid administration."

Regarding the structural changes in the thyroid glands of Basedow's disease, he thinks their significance has been a matter of inference rather than of direct demonstration, as such changes are variable and may signify an *altered* secretion rather than an *excessive* secretion, and seems to agree with Marine that some of the cardinal symptoms of exophthalmic goitre are effects of some disturbance of metabolism and not primarily the direct result of the thyroid changes. He publishes a large number of experiments in the feeding of thyroid extract upon a great variety of animals and also one experiment upon himself. While Carlson was able to produce toxic symptoms and obtain symptoms of loss of body weight, gastero-enteritis, and dysentery, he concludes: "It would require considerable imagination or an undue influence of one's wish or one's judgment to identify the symptom-complex of excessive thyroid feeding in experimental animals with the exophthalmic goitre syndrome in man. The symptoms in experimentals may or may not be an expression of hyper-thyroidism. Other lines of investigation must determine that point. The symptoms are not those of exophthalmic goitre."

KLOSE,^{4 5} in his address before the German Surgical Congress of 1911, states that in spite of all the advances that have been made in the investigations of Basedow's disease by Kocher and others we do not know at the present time whether the disease is due to a hyper- or dys-thyroidism; whether the variation from the normal is a quantitative or qualitative one. Klose injected intravenously thyroid pressure fluid, or "press-saft" (taken from fresh Basedow thyroids), in over one hundred animals. He was apparently able to produce typical Basedow's

disease in these animals. The symptoms following the injection were elevation of temperature, irregular pulse, disturbances of respiration, tremor, sweating, and the elimination of albumin and sugar. In rare instances exophthalmus was noticed. The blood-picture showed for a short time an increase in the general amount of leucocytes, especially of the polynuclear cells, but the typical blood-picture of Basedow's disease, or lymphocytosis, soon followed. A marked reduction in the blood-pressure was also noted. The blood-picture following the injection was so characteristic, as compared to the injection of "press-saft" obtained from the ordinary or simple struma, that Klose regards it of value as a differential diagnostic method. Klose found also that the intravenous injection of potassium iodide in dogs gave a very similar reaction. He therefore came to the following conclusions: that Basedow's disease is not a hyper-thyroidism, but rather a dys-thyroidism. The thyroid gland does not have the normal activity for storing up iodothylin, but rather permits it to be carried into the circulation in a form which is as yet unknown, but to which Klose has given the arbitrary name of "Basedowiodine."

BIRCHER, * in a recent contribution, as well as in his previous article published in the *Bd. 1 des 15 Jahrgangs der Ergebnisse der allgemeinen Pathol. u. pathol. Anat.*, p. 225, reports his endeavors to experimentally reproduce Basedow's disease. In his later experiments he employed implantation of thymus gland into the peritoneal cavity of lower animals. Bircher was led to these experiments by the reports from other authors (Capelle, Thorbecke, Hart, Grecke, Garre), who reported a large number of thymus deaths in cases of Basedow's disease. He therefore came to the conclusion that in Basedow's disease the thymus gland plays an important rôle, and that its importance in this disease is even as great as that of the thyroid gland itself. He was especially impressed with this thought after looking over the statistics of deaths from Basedow's disease and of its cure by Garre following the operation of thymectomy and also by the production of Basedow's symptoms after the injection of thymus juices. Bircher relates that in five dogs he has produced the whole picture of Basedow's disease in a manner so pronounced as had heretofore never been observed. In these experiments Bircher used pieces of thymus gland which he obtained from patients who did not suffer from Basedow's disease but rather died from persistent thymus gland and narcosis shock or from cases of stenosis of the thorax in which a thymectomy had been performed. The pieces of thymus gland were used in a very fresh state, exposed to the air for only about a half minute, and directly implanted into the peritoneal cavity of dogs. He publishes a photograph of one of these dogs showing the typical picture of Basedow's disease,—i.e., exophthalmus and enlarged thyroid gland. In this dog a piece of thymus gland about one centimetre thick, obtained from a case of endemic Cretinism, was implanted into the omentum. The first symptoms manifested themselves after forty-eight hours. The dog became very irritable and excited and sprang about his cage like one possessed. He took but little nourishment and had an enormous thirst; the exophthalmus showed itself on the fourth and reached its height

after the twentieth day, remained stationary for a few days, and then became less apparent. It did not disappear entirely until after five months. On the third day tachycardia appeared, the pulsations became very rapid, as high as 180, there was also a tremor of the legs and paws, as well as of the whole body. The enlargement of the thyroid gland could still be felt after four or five weeks. At the end of the first week a pronounced lymphocytosis was present, which, however, did not persist. The appetite was greatly diminished; a diet rich in albumin produced glycosuria—no pronounced dysentery. The tachycardia lasted three months, but the enlargement of the thyroid remained after most of the other symptoms disappeared.

Two of these dogs were allowed to live for further study; in the other three the operation of total thyroidectomy was performed. These animals died very rapidly from acute cachexia thyreopriva.

Bircher thinks that these experiments, which for the first time have produced so pronounced and typical an exophthalmus, demonstrate the correctness of the correlation of Basedow's disease with the function of the thymus gland.

BARUCH,⁷ in a recent contribution, reviews the work of Bircher as well as his own experiences, now of several years, in the experimental production of Basedow's disease. Baruch states that for such experiments he used ordinary goitres, usually of the parenchymatous variety, or simply the colloid variety. These goitres were prepared freshly a few hours after the operation, ground up very finely so that it could be injected into the animals through a cannula of large calibre. Injections were made either subcutaneously or into the peritoneal cavity, usually the latter. With this method he produced typical Basedow in a large series of dogs as well as in rats and rabbits. After injection the dogs showed unusual irritability and nervousness, decided emaciation, loss of hair and dysentery, tachycardia, glycosuria, lymphocytosis, and, in a few instances, pronounced exophthalmus. Three of such dogs with exophthalmus were demonstrated by Baruch on July 10, 1911, before the Breslau Surgical Association. One of these dogs, as a result of lagophthalmus, developed an ulcer of the cornea. For these experiments he found that very young animals, especially females, were more susceptible. He injected from five to twenty centimetres of the macerated gland, usually extending over a period of eight days. The exophthalmus usually developed on the twelfth or fourteenth day. Baruch claims that in the experiments of Klose the toxic principle of the Basedow thyroid gland is to be found only in very small quantities,—i.e., "press-saft," as used by that investigator. Parallel experiments to those of Klose were made by Baruch in which he used the Basedow thyroid gland instead of the ordinary small forms of goitre, and he found that he could produce the symptoms of the disease much quicker and more often than with the ordinary gland. Baruch believes that the toxic principle does not leave the thyroid gland and enter into the "press-saft." Baruch states that his experiments, as well as those of Bircher, demonstrate the interesting fact that one can reproduce the typical picture of Basedow's disease by the employment

of certain tissue which does not necessarily come from a patient with Basedow's disease.

FRENCH⁸ undertook to study the comparative toxicity of different tissues in animals susceptible to thyroid feeding, the object being to discover whether the effects of commercial thyroid extract when administered are specific or whether similar effects could be produced by other animal tissues prepared and administered in the same way; "Whether it is due to decomposition products or whether it is due simply to the great amount of proteid matter ingested by an animal unaccustomed to such a diet." His conclusions were as follows:

1. Thyroid in the forms used—fresh, stale, and desiccated, either commercial or laboratory prepared—contains a substance that is decidedly toxic for some animals.

2. The other animal tissues used—brain, liver, spleen, kidney, and skeletal muscle—give no evidence of toxicity when prepared and fed in the same way in equal or even larger quantities.

3. While the study does not indicate the nature of the toxic substance, it would seem to show conclusively that it is not due to protein in the food.

Thymus Gland.—The correlation of the ductless glands of the body in their functional activity has led to many theories regarding the cause of the primary thyroid change in Basedow's disease. The most important ductless gland which experimental and clinical evidences seem to show to be intimately associated with the thyroid is the thymus gland. This gland has been found persistent in severe cases of Basedow's disease and has been experimented with by Bircher in the artificial production of the disease, as already given above, and to it has been ascribed the essential factor in producing the thyroid change. The thymus gland has even been removed for the cure of Basedow's disease, and apparently with good effect.

MATTI,⁹ in showing the relation of the enlarged thymus gland to exophthalmic goitre, reports ten cases of his own and has compiled one hundred and thirty-three cases from literature. He states that fully 76.5 per cent. of all exophthalmic patients who died after operation had an unusually large thymus gland. Matti states that it seems very evident that the thymus and thyroid gland are in concert, and that each aggravates the morbid condition induced by abnormal functioning of the other.

GARRE¹⁰ states that the conception of a surgical operation upon the thymus gland for the relief of Basedow's disease was based upon the fact that in cases of severe and fatal forms of Basedow's disease death is almost without exception due to a persistent thymus. In one case of

severe Basedow's disease he performed a thymectomy without touching the goitre, and obtained improvement in the heart's action, the disturbance of the characteristic Kocher's blood-picture, and a decided increase in the body weight. In a second case he performed the operation, but at the same time removed one-half of the thyroid gland, and obtained a good result. He quotes Capelle, who claims that the symptoms of Basedow's disease are intensified in the presence of an enlarged thymus gland. He draws the following conclusions regarding the correlation of the thymus and thyroid glands in Basedow's disease:

First.—After extirpation of the thymus gland the characteristic blood-picture of Kocher disappears, just as it does after successful thyroidectomy.

Second.—His assistant, Doctor Bayer, has been able to reproduce the typical blood-picture in animals by the peritoneal injection of thymus pressure fluid from a case of Basedow's disease.

Third.—After the removal of the thymus gland six months later retrograde processes were observed in the thyroid gland removed at a secondary operation and subjected to microscopic examination.

Fourth.—In thyroidectomized animals Gebele, by the employment of the thymus gland, was able to prevent the typical condition of cachexia strumepriiva.

Fifth.—The experiments of Bircher, who has been able to reproduce pronounced Basedow's disease in dogs by the intra-peritoneal implantation of fresh pathological persistent thymus.

Garre does not wish to go so far as Hart, who speaks of a thymogenic cause for Basedow's disease, but thinks that there is a certain group of Basedow cases which are complicated by a persistent hyperplastic thymus gland. These cases can be characterized as severe types of the disease. He further relates (p. 58) that persistent thymus gland is found in ninety-five per cent. of all fatal cases of Basedow's disease in which a thyroidectomy had been performed.

CROTTI and BOWEN¹¹ have emphasized the importance of the enlarged thymus gland in those cases of death following the operation of thyroidectomy for Basedow's disease and have been able to diagnose enlargement of the thymus gland with the Röntgen ray. They reported five cases of this kind.

CAPELLE and BAYER,¹² in their contribution on thymectomy in Basedow's disease, state that they and others are of the opinion that the symptoms of Basedow's disease are made more severe when a thymus gland is present, but do not agree absolutely with Hart, who goes still further and ascribes to the thymus gland (Hart, *Münch. med. Wochenschrift*, 1903, 13, 14) the primary cause of Basedow's disease in its direct action by producing pathological changes and oversecretion of the thyroid gland.

V. MIKULICZ^(13 14 15) came to the conclusion that the conception of Basedow's disease should in no way be explained solely through an excessive function of the thyroid gland. His conception of the disease as given by him before the German Surgical Congress of 1895 is that the thyroid gland acts as a multiplicator or intensifier of the symptoms.

In view of the experimental production of Basedow's disease through the transplantation of the thymus gland by Bircher, as well as the experiences of Garre with thymectomy as a cure for Basedow's disease, it is not at all improbable that the "multiplier" theory of Mikulicz with the thymus gland as the primary lesion may perhaps be correct.

Artificial Clinical Production of Basedow's Disease and Hyperthyroidism.—Basedow's disease has been accidentally produced in man by the excessive administration of thyroid extract and iodine preparations. It is a well-known clinical fact that the administration of such remedies to patients suffering from exophthalmic goitre will cause an exaggeration of all of the symptoms.

Von Notthaft¹⁸ reports a very interesting case of a man in whom artificial production of acute Basedow's disease occurred from the use of thyroid extract taken for obesity. The man developed a typical picture of Basedow's disease, exophthalmus, tachycardia, nervousness, emaciation, and glycosuria, the symptoms disappearing again after ten months. This case has become classical in the literature of Basedow's disease, and a detailed abstract of it will not be amiss.

VON NOTTHAFT'S case was as follows:

Male, aged 43, who had always been well, with no neuropathic taint, no alcoholic or venereal history, suffered for several years from progressive obesity. The associated discomfort led him to take various "cures."

The results following these obesity cures were not good, and he then tried the use of thyroid tablets (thyroidin) without consulting a physician. In December, 1896, he procured, through the aid of a druggist friend, some thyroid gland tabloid preparations of Burroughs, Wellcome & Co. (0.3g) and within a period of five weeks he used about 1000.

He began with 3 tabloids t.i.d., and as the results were not rapid enough to suit him he took 10 tablets t.i.d., and later 15 tablets t.i.d. He lost about 30 pounds in weight, weighing 220 pounds when he began, a decrease of about 13.64 per cent., an exorbitantly high ratio. The first symptoms of Basedow's disease set in at the end of the third week and were evidenced by an irritative cough with swelling of the neck. At the end of the fourth week the neck enlargement had increased, and palpitation of the heart, with insomnia, was present. About the end of the fifth week he experienced excessive thirst.

Toward the end of the third week his symptoms grew worse, and by the end of the sixth week he desisted in further self-medication and consulted medical advice. After the appearance of the irritative cough,

he observed that his shirt collar was too tight; the circumference of the neck seemed to have suddenly increased about 3 centimetres; he became dyspnoëic and had palpitation of the heart. Fatigue and depression were marked. He became so excitable that he could not sleep at night; this was coupled with the fact that he could hear his neck arteries beat. His appetite remained undisturbed, stools and urine were normal. An attack of rheumatism in the last days of the treatment he ascribed to the excessive sweating which had been present for some days. The loss of weight was as follows:

At beginning.....	220 pounds; 3 tablets t.i.d.
Middle of first week.....	? pounds; 10 tablets t.i.d.
Towards end of first week.....	218 pounds; 10 tablets t.i.d.
End of second week.....	214 pounds; 10 tablets t.i.d.
End of third week.....	206 pounds; 10 tablets t.i.d.; first symptoms.
Beginning of fourth week.....	? pounds; 15 tablets t.i.d.; increased symptoms.
End of fourth week.....	200 pounds; 15 tablets t.i.d.; insomnia and palpation.
Beginning of fifth week.....	? pounds; 2 tablets t.i.d.
End of fifth week.....	196 pounds; 2 tablets t.i.d.; thirst excessive.
Beginning of sixth week.....	192 pounds; until then 3 tablets t.i.d.

Upon examination on January 15, 1897, the following were the physical findings:

Adiposus well developed, the face is slightly reddened; the entire skin feels very moist. At first glance one notes two prominent symptoms: considerable exophthalmus and a moderate tremor, which is more pronounced in the hands. The neck is thick, and a marked enlargement of the thyroid gland can be noted, the neck circumference at the largest point is 47 centimetres. Palpation shows the thyroid with both lobes considerably enlarged (*Nicht unerheblich vergrößert*); palpable thrill and vascular sounds are not present. The carotids and brachials pulsate visibly. Pulse is soft, regular, 120; respiration about 24 and more. Axillary temperature, 37.3° C., weight 192 pounds. Liver and spleen unchanged. Abdomen soft, not sensitive to pressure. Lung and heart outlines normal; apex beat increased and widened in fifth intercostal space, within the mammillary line. Exophthalmus equally prominent on both sides; can completely close the lids; Stellwag's sign is clearly noted, and on lowering of the visual level the upper eyelid moves only imperceptibly downward (Graefe's sign). Pupils react, vision, eye grounds and power of convergence show no abnormality. The protruded tongue trembles markedly, as is the case in a patient affected with cerebral lesion. The urine contains 1 per cent. of sugar; daily quantity 3 litres plus.

Thyroid medication was stopped at once; hypnotics and Fowler's solution were administered. In ten days improvement was first manifested by an improved mental condition, then the nervousness abated, and fourteen days after the first consultation the patient stated that he felt better than ever. The sugar in the urine disappeared after ten days. The polyuria and thirst began to disappear after this. For about four weeks no effect was noted on the heart and pulse, then slowing of the pulse-rate to 80 and 90; but even eight weeks after examination slight excitement sufficed to run it up to 110 and 120. At this time the apex beat was hardly palpable any longer. The irritative cough left after the eighth day; the tremor was no longer observed after four weeks. On the other hand, struma, exophthalmus, and the other eye phenomena remained for six months and then gradually receded. In October,

1897, the patient was again examined and none of these symptoms were found. In the meantime the patient (without the doctor's knowledge) took 0.3g. t.i.d. of iodothylin and remained well. His weight is now 204 pounds.

BALL¹⁷ reports a very interesting case of exophthalmic goitre with acute symptoms and death probably caused by the use of thyroid extract. Patient was a female, aged 24, who had been taking five-grain tablets of thyroid extract for over a year to reduce a thyroid swelling. Death took place from acute thyroidism. Before death, temperature reached 106, pulse 200, respiration 70. The acute symptoms lasted less than four weeks. Autopsy gave negative findings relating to the cause of death other than that of acute exophthalmic goitre.

THEODORE KOCHER¹⁸ ²⁰ reports a case of acute Basedow's disease as the result of the internal and local treatment of a simple goitre with iodine preparations. After three weeks the patient had all the typical symptoms of Basedow's disease, and after extirpation of the thyroid, which was about the size of a man's fist, it was found to contain an unusually large amount of iodine. Kocher thinks this condition should be termed iodism of the thyroid gland, as the symptoms are identical with those that are obtained by the administration of large doses of thyroid extract. He states that mild symptoms of Basedow's disease are to be observed very often in cases of ordinary goitre where there is a misuse of iodine. He has designated this condition as a special form of the disease, namely, "Iodbasedow" or "Iodinebasedow."

PINELES²¹ verifies Kocher's observation, and reports six cases of Basedow's disease produced through the administration of iodine.

PULAWSKI¹⁹ reports three cases in which he observed Basedow symptoms developed after the treatment by iodine and thyroid extract.

WOLFSOHN²² experimented to determine the sensitiveness of Basedow patients to the ingestion of iodine preparations. He utilized for these experiments guinea pigs in which he had previously injected serum obtained from Basedow patients. He found that after twenty-four hours these animals were oversensitive to iodoform.

SELLI, BERG, and WOLFSOHN²³ have observed thyroidism and acute thyroiditis after the administration of potassium iodide and iodine preparations.

THEODORE KOCHER²⁴ relates that Tourin, one of his assistants, has examined a large number of cases of ordinary colloid goitre and found no change in the normal blood-picture. However, after the administration of iodothylin he obtained the typical blood-picture of Basedow's disease,—i.e., typical leucopenia with diminution in the neutrophile cells, with an increase in the lymphocytes.

Pathology of the Thyroid Gland in Basedow's Disease.—Specific changes in the thyroid gland for Basedow's disease have been described by the Kochers, MacCallum, Wilson and MacCarty. An enlargement of the thyroid gland is always present in Basedow's disease. This has been commented upon frequently by C. H. Mayo and the Kochers. A case of Base-

dow's disease without an enlarged thyroid gland at operation is as yet to be demonstrated.

A. KOCHER,²⁵ in a histological and chemical examination of one hundred and sixty thyroid glands removed from cases of Basedow's disease, thinks that the conception of a papillary cylindrical cell hyperplasia as the specific histologic picture is not at all satisfactory, as such changes are only found in herds or may be entirely absent. This conception has given rise to the belief that there are no changes in the thyroid gland which are absolutely characteristic of the disease. Personally, A. Kocher agrees with the latter view. Kocher found all manner of changes in the one hundred and sixty cases examined, and definite conclusions could only be arrived at after taking into consideration the microscopic picture, the clinical examination, and the patient's history. The composite picture which Kocher obtained that might be said to be characteristic for Basedow's disease can only be expressed by saying that "evidences of increased absorption in all parts of the gland are to be found." In such glands there is found constantly increased liquidation of the contents of the follicles, with a relative or absolute enlargement or increase of the cells. These changes were dependent upon the amount and concentration of the iodine content of the follicles. He states that in Basedow's disease the thyroid gland takes up more iodine than does the normal gland. This storing up of iodine as compared with the normal gland varies greatly,—in other words, no relative proportion between iodine content and colloid, as is the case in the normal state. A more liquid iodine-containing content of the follicles gives a severe form of Basedow's disease.

Basedow symptoms do not occur where there is a dense content of the follicles. When such is the case there is usually an improvement in the general condition of the patient, while an increase of the iodine content without thickening of the content means an exaggeration of the symptoms. In Basedow's disease more iodine is taken through the thyroid gland than in the healthy state. The increase in vascularization was more pronounced in those cases where the secretion in the follicle was thin.

Histologic changes are dependent and secondary to the variation in the composition in the follicle content. He comes to the conclusion that in Basedow's disease there is a greater increase and absorption of thyroid products into the general circulation.

A. KOCHER²⁶ again reports the examination of thirty-five thyroid glands removed from patients with Basedow's disease, and states that his experience is now so extensive that from the clinical manifestations he is able to predict the exact histological conditions which will be found in the thyroid. He classifies them under four different groups. Kocher has been experimenting with the transplantation of portions of Basedow thyroids in patients suffering from hypo-thyroidism, as well as with desiccated Basedow thyroids. The effect seems to be the same as when the normal thyroid gland is used. Kocher thinks that this speaks for a hyperthyroidism as the cause of Basedow's disease and as an

evidence against the dys-thyroidism theory. He states that the amount of iodine found in the thyroid gland of Basedow patients varies greatly—either far above or far below the normal average.

WILSON and MACCARTY^{27 28} have described typical changes in the thyroid gland of patients suffering from Basedow's disease. These changes consist mainly in the histologic picture, showing an increase in the epithelial or secreting surface of the gland. In the Surgical Section of the American Medical Association, at its recent meeting, Wilson of the Mayo clinic made the statement that in eighty per cent. of the cases he could determine the clinical symptoms from the histologic findings.

MARINE and LENHART¹ report their studies of sixty-nine thyroid glands removed from exophthalmic patients. They found the changes variable. The most constant change, however, was found to be an active hyperplasia of the thyroid in connection with hyperplasia of all the lymphoid tissues. The exophthalmic goitre syndrome may co-exist with a normal thyroid, with a colloid goitre, with an active hyperplastic thyroid, as well as with an atrophic thyroid, or may be found with a tumor of the thyroid. They claim that active thyroid hyperplasia means thyroid insufficiency, and that the iodine content of the gland varies inversely with the degree of active hyperplasia. They also state that the degree of active lymphoid thyroid hyperplasia is therefore the best index of the severity of the disease.

Blood Changes in Basedow's Disease.—THEODORE KOCHER²⁹ reports accurate blood examinations in one hundred and six cases of Basedow's disease, and describes a characteristic blood-picture. This blood-picture consists in a reduction of the polynuclear neutrophile leucocytes with an absolute or relative increase in the lymphocytes. He not only holds this blood-picture as typical, but utilizes it for the early diagnosis of the disease as well as for its prognosis. Both medical and surgical treatment influence this blood-picture very much. After thyroidectomy the total number of leucocytes are increased. The neutrophile cells increase and the lymphocytosis diminishes. In this manner Kocher is able to prognosticate as to cure after surgical operation. As Kocher operates many of his cases in successive stages, beginning with ligation of one or more of the superior thyroid arteries and gradually leading up to the thyroidectomy; he can observe the amount of improvement after each operation by the blood examination. The blood examinations of Kocher have been verified by v. Lier, Buhler, Turin,²⁸ and others.

REID HUNT³¹ endeavored to throw some light upon the question of an excess of thyroid secretion in the blood of exophthalmic patients. He showed that when small amounts of thyroid extract are fed to mice for a few days the latter acquire markedly increased resistance to acetonitrile. He reports some experiments on white mice in which exophthalmic goitre blood was injected and the injection of normal blood used as a control. He states "That it required nearly twice as much acetonitrile to kill the mice which had received the exophthalmic goitre blood as it did those which had received normal blood or simply crackers." Reid Hunt thinks this evidence should be accepted as demonstrating that the blood of exophthalmic goitre patients contains thyroid secretions. These experiments were corroborated by Ghedini,³²

while Lussky,⁸⁸ after extensive experiments with the test upon several species of animals, as well as in one case in man, after thyroid feeding, states: "Inasmuch as there are, at least under certain conditions, other substances than thyroid in the blood which increase the resistance of mice to acetonitrile, and since these substances may vary in different individuals, or at different times in the same individual, the Hunt test on human exophthalmic goitre blood lacks sufficient control. In the case of positive results it is impossible to say which substances are present." The Kochers, however, regard Hunt's test of great value.^{24 20}

Secondary Basedow's Disease.—One of the most important facts which speaks for the thyroid origin of the symptoms of Basedow's disease is the so-called secondary form of Basedow's disease,—*i.e.*, symptoms of hyperthyroidism or typical Basedow's disease appearing in connection with other affections of the thyroid gland, such as simple and adenomatous goitre, cancer and inflammations.

It is a common clinical experience with those who see many cases of goitre to have patients present themselves with a history of a long-standing enlargement of the thyroid, while the symptoms of hyperthyroidism or exophthalmic goitre are only of recent date. This has been observed and commented upon by Kocher (20, p. 10) and others.

The frequency of hyperthyroidism and Basedow's disease in association with malignant diseases of the thyroid has been observed by Bloodgood and Kocher.

Kocher^{24 20} speaks (p. 625) of cases of malignant struma which presented themselves with very pronounced symptoms of Basedow's disease, and the malignant nature of the goitre was not discovered until it was too late for radical operation.

Pieri⁸⁴ reports a case of spontaneous cure of Basedow's disease as a result of suppurative thyroiditis in which a part of the thyroid gland was destroyed by the inflammation.

Kocher's Conclusions.—Kocher,²⁴ 1911, in a very exhaustive *résumé* of the advances made in the study of Basedow's disease, states that the following conclusions relative to this disease are warranted:

First.—All cases of Basedow's disease are based upon pathological changes in the thyroid gland which produce a disturbance in the function of that gland. No one has as yet been able to demonstrate a Basedow case with normal thyroid gland. He has repeatedly shown enlargement of the thyroid gland in such cases at the time of operation where the thyroid gland could not be palpated before operation.

Second.—The disturbance of function manifests itself in the thyroid

excretion, which has a toxic action upon the nervous system. The only constituent of the thyroid gland whose physiologic and pathologic action is understood at the present time has been shown by Oswald and A. Kocher to be the iodine-containing thyro-globulin found in the colloid of the alveoli in the thyroid gland.

Third.—According to the researches of Bauman, Roos, Oswald, Reid Hunt, and A. Kocher, the thyroid secretion which enters the circulation depends upon the quantity of iodine which it contains for its action.

Fourth.—That Basedow's disease is a hyperthyreosis in the sense that either more secretion from the thyroid gland enters the circulation or, if not an excessive amount of secretion, an excessive amount of iodine.

Fifth.—Up to the present time we have no proof of a dysthyroidism in which the abnormal thyroid gland gives off its iodine content in the form of pure iodine. For the hyperthyreosis or hypersecretion as the functional disturbance of the thyroid gland in Basedow's disease we have the facts that by the administration of thyroid extract from normal glands in cases of cachexia thyreopriva the symptoms of that disease can be made to disappear. On the other hand, Basedow symptoms can be produced with the same extracts if given in large doses, while symptoms of the disease can be produced experimentally by the administration of thyroid extract, and the characteristic blood-picture as described by A. Kocher can be reproduced. This blood-picture is the most simple and best means of diagnosis in doubtful cases of Basedow's disease.

The Results Obtained from the Treatment of Basedow's Disease Based upon the Hyperthyroidism Theory.—The results obtained from treatment directed toward the overaction of the thyroid gland in Basedow's disease speak more in favor of the thyroid origin of the disease than do any other evidences or data which we possess at the present time. Such treatment has been either the (a) serum or antitoxin therapy, (b) the X-ray, (c) the surgical treatment.

(a) *Serum Therapy.*—The fact that there exists an antitoxin for this disease from which cures and good results are being obtained is one of the most potent arguments in favor of the thyroid origin of the disease. Various sera have been recommended and employed. These are prepared from animals from which the thyroid gland has been removed or from animals inoculated with extracts of thyroid gland taken from patients suffering from exophthalmic goitre. The serum of Moebius and that prepared by Rogers and Beebe are those most widely used. Good results from the serum treatment are reported by Rogers and Beebe³⁵ and Denic and Gardere.³⁷

The latter report in detail the cure of a pronounced case of Basedow's disease by the use of Moebius's serum.

BEEBE,³⁶ reporting the results obtained from the use of his serum, divides the cases into three groups. In the first group are those cases who have had the disease only for a short time, from two weeks to six months. In the second group are placed those patients who have had the disease for some time, from four to eight years. In the third group, those atypical cases which give the history of Graves's disease over a very long period of years.

The best results from the serum treatment are obtained with patients belonging to the first group; the percentage of recovery and marked improvement is 80 per cent. In the second group 50 per cent. of the patients may be cured or improved, while in the third group the serum finds its smallest application, and the treatment cannot be relied upon alone, and no definite statement regarding the serum treatment in this class of cases can be made.

(b) *X-ray*.—The fact that the X-ray applied only to the thyroid gland can modify, improve, or cure hyperthyroidism and Basedow's disease is another argument in favor of the Moebius theory.

RAVE³⁸ reviews the results obtained by the X-ray treatment of Basedow's disease and shows that the X-ray does have a favorable action upon the disease. He states that in fifty-one patients out of three hundred and twenty-one the nervous symptoms were improved. He comes to the conclusion that the X-ray treatment should be employed if for any reason an immediate surgical operation cannot be performed. He states that with this treatment the thyroid gland is reduced in size and specific symptoms of Basedow's disease, such as exophthalmus, cardiac and nervous symptoms, as well as the general condition of the patient, are improved. The patients also took on weight.

SIMON³⁹ reports a case of Basedow's disease treated by the administration of iodine in which there were very pronounced manifestations of iodo-thyroidism, which was brought to a cure in a very short time by X-ray treatment of the thyroid gland.

BERGER and SCHWAAB⁴ sent question blanks to a number of German internists asking for their experiences in the Röntgenization of the thyroid gland in the treatment of goitre. The majority of clinicians who replied stated that favorable results were obtained in Basedow's disease, and some regarded it as fully equal to any other therapeutic method.

The enlargement of the thyroid gland subsides after this treatment, as well as do the other specific symptoms of Basedow's disease.

(c) *Surgical Treatment*.—MELCHOIR,⁴¹ in the most exhaustive and complete *résumé* of the literature of Basedow's disease up to 1910, states that in the majority of cases of

Basedow's disease it is possible, through the diminution in the size of the goitre by surgical measures, to cure, or at least to produce an improvement which borders on absolute cure. He gives the available figures of 65 to 75 per cent. of cures, and further states that so far the operative treatment of Basedow's disease is the best remedy. The cure in some cases is proportional to the amount of thyroid tissue removed. The early operation is recommended for two reasons:

First.—That the operative mortality in advanced cases of Basedow's disease is very high, while in the beginning of the disease it is very low, not higher than that for ordinary simple forms of goitre.

Second.—Even if a successful operation is performed in advanced cases, the heart changes very seldom are relieved.

Melchoir reviews the results obtained as follows:

Wolff	1898.....	9 cases.
Helferich	1898.....	6 cases.
Von Mikulicz	up to 1900.....	18 cases.
Witmer and Kroenlein.....	1900.....	23 cases.
Kummell	in 1901.....	20 cases.
Curtis	in 1903.....	11 cases.
Koenig	in 1905.....	8 cases.
Hartley	in 1905.....	21 cases.
Riedel	in 1906.....	50 cases.
Garre	in 1908.....	28 cases.
Klemm	in 1908.....	32 cases.
Kocher	up to 1908.....	320 cases.
Mayo	up to 1907.....	176 cases.
Halstead	1907.....	90 cases.
Landstrom	1907.....	54 cases.
McCosh	1908.....	22 cases.
Hanel	1909.....	21 cases.

A total of909 cases.

There was approximately 65 to 75 per cent. of cures.

C. H. MAYO⁴⁸ reports over eleven hundred operated upon for hyperthyroidism at the Mayo clinic, and states that about seventy per cent. of the patients consider themselves cured, and apparently they are well. The others were improved but not well on account of late operation when severe secondary effects of disease were present.

H. ALAMARTINE and PERRIN⁴⁹ reviewed the results obtained by v. Mikulicz, Kroenlein, Kocher, Kummell, Riedel, Garre and Ackerman from their operations on the thyroid gland for the relief of Basedow's disease. They endeavored to determine the late results of the operation, and only those cases which had been under observation at least three years after the operation were considered. In 120 cases 85 or 70.8 per

cent. were absolutely cured; in 27, or 22 per cent., there was marked improvement, and in 8, or 6.6 per cent., there was no improvement.

The general favorable result, approximately 70 per cent. of cures as given above, seems to prove that not only is the thyroid gland the seat of the principal disturbance in Basedow's disease but that we cannot ascribe the cure to any other reason but to the operation itself.

Various methods of operation have been employed, such as ligation of the thyroid arteries, pole ligation, resection of the cervical sympathetic ganglia, resection of one lobe either alone or in combination with a hemi-section or ligation of the opposite lobe, but experience seems to show that the best results are obtained from the resection operations. The surgical treatment of this disease has been progressing and is better understood to-day than it was a few years ago, and many of the cases which formerly were not cured or relieved by a surgical procedure did not have a sufficient amount of thyroid tissue either rendered functionless or removed. At the present time there is no definite standard for the amount of thyroid tissue to be removed; this is largely a matter of judgment and experience with the operator.

Halstead ⁴⁴ states that although thousands of operations have been performed the world over, for the cure of Graves's disease, we are not as yet in a position to state how much of the thyroid gland should be removed in any given case. Some of the severest cases have been sufficiently cured by the removal of one lobe, and in some of the mildest the excision, almost total, of both lobes has been necessary to bring about a cure or a satisfactory condition.

CONCLUSIONS.

From the foregoing review of the experimental and clinical evidences relating to the thyroid origin of Basedow's disease the following conclusions are warranted, viz:

1. Basedow's disease can and has been produced experimentally in lower animals by the injection of thyroid pressure fluid (Klose), by implantation of the thymus gland (Bircher),

and by the injection of the macerated thyroid gland (Baruch). Symptoms closely resembling Basedow's disease can be produced in animals by thyroid feeding.

2. The evidence at hand indicates a close relationship between the thymus and thyroid glands.

3. That the symptoms of Basedow's disease are due to either an excess or perverted secretion of the thyroid, with the primary disturbance existing in the thymus gland, the action of the thyroid being that of a "multiplier" according to the theory of von Mikulicz.

4. Basedow's disease has been produced in man by the excessive administration of thyroid extracts and preparations of iodine.

5. That there are changes in the thyroid gland, chemically, macroscopically, and microscopically, which are characteristic for Basedow's disease.

6. Typical Basedow's disease or symptoms of hyperthyroidism (so-called secondary Basedow's disease) occurs after or in connection with other affections of the thyroid, such as simple and adenomatous goitre, cancer, and inflammations.

7. That there is a characteristic blood-picture in Basedow's disease which disappears after the surgical removal of a sufficient amount of the diseased thyroid tissue.

8. The successful treatment of Basedow's disease by measures directed toward the thyroid itself, as well as by serum therapy, proves the thyroid origin of the disease.

9. Basedow's disease can be cured by the surgical removal of portions of the gland in approximately 70 per cent. of all cases.

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A CHEEK DEFECT AND ITS REPAIR BY PLASTIC OPERATION.*

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HISTORY OF CASE.

A BOY, 16 years of age, was referred to me for treatment by Dr. John M. T. Finney. He was admitted to the Union Protestant Infirmary, January 25, 1912, suffering from a large defect involving entire thickness of the right cheek (Fig. 1).

The patient said that in February, 1910, he had a severe attack of typhoid fever, and was in bed about ten weeks. While he was in a comatose condition a small ulcer appeared on the inside of the right cheek, which spread and finally destroyed the entire thickness of the cheek. This was evidently *carcnum oris*.

When admitted there was a circular, funnel-shaped opening involving the entire thickness of the right cheek. The external diameter was 6.3 centimetres, and the internal was 3.8 centimetres. The defect extended from the level of the hard palate to the floor of the mouth, and from the ramus of the jaw to within half an inch of the angle of the mouth. The thickness of the posterior wall was 4.4 centimetres. The walls of the defect were made up of very dense scar tissue of woody hardness. The scar tissue also involved the adjacent soft parts of the cheek. Posteriorly, a thick column of scar tissue encroached upon the oral cavity, and this, with a smaller band anteriorly, seemed to bind the jaws together.

Both the upper and lower jaw bones on this side had evidently been involved in the destructive process, and were covered with dense scar tissue, which was continuous with the walls of the defect. The parotid duct could not be located. All the teeth were missing on the right side, excepting one or two incisors. The tongue, on this side, was closely adherent to the body of the

* Read before the Southern Surgical and Gynæcological Association, December 18, 1912.

lower jaw, and along the floor of the defect, to such an extent that, of the right side of the tongue, only the tip could be moved.

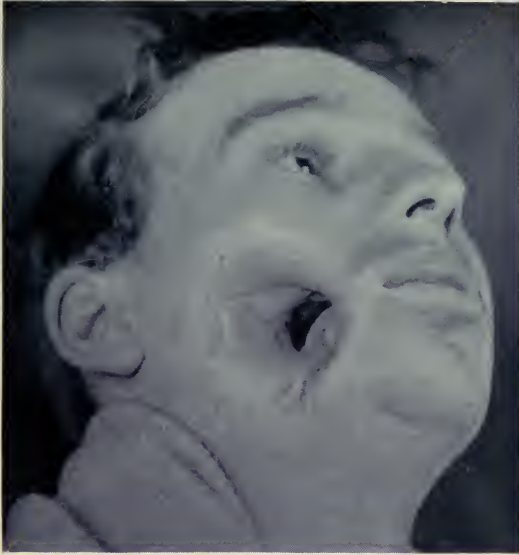
The patient was unable to open his mouth even with the greatest effort. This condition seemed due to the scar tissue, and not to any trouble with the joints, as a certain amount of joint movement could be demonstrated. All of the teeth were in bad condition. Articulation was very indistinct, and talking was impossible unless the opening was plugged with a dressing. The patient was obliged to force his food with his finger back behind the teeth on the left side, and was unable to feed himself through the defect, as the unequal movements of the tongue forced the food back through the opening.

After a careful study of the case I came to the conclusion that for the repair of this large defect a flap with a broad pedicle presented the greatest promise of success, as a good blood supply was imperative to combat infection and to nourish the flap until the new vessels from the surrounding tissues could take care of it. It was necessary that this flap should fulfil several conditions: (1) It should not contract appreciably after being implanted. (2) It should have enough thickness to fill the defect without causing a depressed area after healing was complete. (3) It should be formed of soft tissue (preferably fat, with whole thickness skin on both sides) which would conform in appearance to the surrounding skin externally and take the place of the mucous membrane in the mouth.

In order to avoid any further mutilation of the face or neck I determined to utilize the right arm, as I was able to secure a flap from this region which would fulfil every requirement.

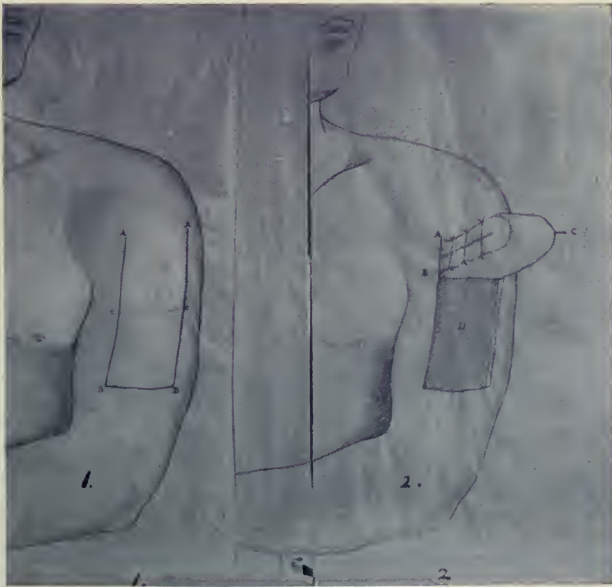
January 29, 1912.—*Operation*: Nitrous oxide-oxygen anæsthesia. A large pedunculated, rectangular-shaped flap 7.5 x 16 centimetres, made up of whole thickness skin, with its subcutaneous fat, was raised from the outer side of the right arm. The base of the flap was in the mid-deltoid region. The flap was folded on itself, and the distal end was sutured to the pedicle and underlying muscle. A few interrupted sutures were placed at intervals in the edges, thus bringing raw surface to raw surface, and forming a flap with a double thickness of fat within, and with whole thickness skin on front and back (Fig. 2). A number of small stab wounds were made in the flap to relieve congestion. The flap was then stretched by means of four

FIG. 1.



Defect in cheek before operation. Note depth of posterior wall and extent of scar-tissue involvement around the opening. The tongue can be seen adherent to the lower portion of the defect.

FIG. 2.



Schematic drawings, showing method of formation of flap. 1. Outline of flap. 2. The flap was folded on itself at C. The distal end B was brought up and sutured to the pedicle and underlying muscle at A. Several sutures can be seen holding the edges together and forming a flap with a double thickness of fat within, and whole thickness skin on front and back. The double faced flap was held flat on a wire frame. It was not transplanted until two weeks later, in order not to disturb the healing process between the raw surfaces, and to allow for shrinkage and the adjustment of the circulation. D, the area from which the flap was raised, was grafted immediately with Thiersch grafts from the thigh.

FIG. 3.



The flap healed into the upper portion of the cheek defect. Note the thickness of the flap and its excellent condition. Photograph was taken nine days after amputation of pedicle from the arm.

FIG. 4.



Result of operation. Photograph was taken December 2, 1912, six months after discharge. The defect is completely filled with a thick pad, which is level with the surrounding skin. The skin of the flap is soft, and of normal color.

sutures on a gauze-covered wire frame, to keep it flat and to control the contraction. Dressed with moist salt gauze. The area from which the flap was raised was grafted immediately with Thiersch grafts from the thigh. Silver foil, rubberized mesh, and dry gauze dressings.

February 11.—The flap was in excellent condition. There had been little shrinkage. The Thiersch grafts on the arm had taken *in toto*.

February 12 (fourteen days after the flap was formed).—*Operation:* Ether anæsthesia. As much as possible of the scar tissue was removed from the sides and upper portion of the defect. This was attended with considerable difficulty and much bleeding. The tongue, which was adherent almost to its base, was freed and drawn to the left side, and an attempt was made to close the raw surface. Even after dissecting out the scar tissue bands the jaws could not be opened to any extent, and this was probably due to the great infiltration of the muscles with scar tissue.

The flap on the arm was then opened across its free end and its edges freshened. The arm was raised into position and the flap was sutured into the defect. Catgut was used in the mouth and through the fat, and silk on the cheek. In this way the upper two-thirds of the defect was filled. The arm was then held by means of a plaster bandage, which also included the chest, shoulder, and head. The flap was dressed with moist salt gauze.

The patient was placed on a Gatch bed and every effort was made to keep him comfortable. Continuous salt solution by rectum was commenced and kept up for several days. Constant attention was given to the toilet of the mouth. Only sterile water was given by mouth until the third day, when nasal feeding was begun and continued until the pedicle of the flap was amputated. The nasal feeding was not commenced earlier, as vomitus would have been difficult to handle.

February 23 (eleven days after implantation).—The circulation seemed well established from the cheek. The flap had healed nicely, both inside and out. The cast was removed, and under local anæsthesia the pedicle was cut through close to the arm.

March 3.—There had been very little shrinkage of the flap since the last note. The general condition of the patient was excellent (Fig. 3).

March 4 (eleven days after amputation of pedicle).—*Operation:* Ether anæsthesia. The scar tissue was dissected out from the lower third of the defect, and, after trimming and freshening the edges of the flap, it was sutured in, so as to completely close the remainder of the opening.

March 18.—The healing, both within the mouth and on the cheek, was very satisfactory, except for a small sinus in the lower anterior angle of the flap, which did not connect with the mouth.

The tongue could be moved freely. Articulation was plainer and the patient could feed himself with more satisfaction than before the flap was implanted. In spite of as thorough excision of scar tissue as could be undertaken and closure of the soft parts, a dense band had re-formed at the anterior edge of the flap, close to the angle of the mouth. This seemed largely responsible for the inability to open the jaws.

March 27.—*Operation:* Ether anæsthesia. An incision was made through the angle of the mouth back to the scar tissue band, which was then excised. The anterior edge of the flap was loosened and sutured to the mucous membrane. As much as possible of the remaining scar tissue was excised or divided, but the involvement of the deep tissues of the cheek did not allow much jaw movement. The angle of the mouth was closed. The jaws were held apart by a wooden wedge forced between the teeth.

April 4.—Some progress had been made in opening the jaws by means of wedges, but this could not be forced on account of great soreness of the teeth. Injections of fibrolysin were begun in hopes that it might have some softening effect on the dense scar tissue, and these injections were continued daily until 26 doses had been given. No softening effect was noted. During the healing there had been a contraction of the scar tissue in some places around the flap, causing a depressed scar.

May 20.—*Operation:* Ether anæsthesia. The depressed scar was excised, and at the same time a further effort was made to loosen the jaws by dividing scar tissue, but with little success.

June 2.—Patient discharged. *Condition:* General health excellent. The defect was entirely closed with a thick flap which was nearly level with the surrounding tissues. There was wonderful improvement in the appearance of the patient. The

flap was in excellent condition. The skin was soft and pliable and of normal color. Within the mouth the skin was whitish and soft, and seemed to be gradually taking on the characteristics of the mucous membrane. It had united as satisfactorily to the surrounding tissues as had the external layer. The jaws could be opened so that the tip of the finger could be introduced between the incisor teeth, and there was considerable lateral motion. There was free motion of the tongue. The boy could talk much plainer than when admitted, and the feeding process was simplified.

The courage and cheerfulness of the patient helped materially during the tedious treatment.

Remarks.—The general physical condition of the patient was of the utmost importance, and rest, fresh air, forced feeding, and tonics were resorted to. In addition, particular attention was given to the cleanliness of the mouth, and the services of a dentist were obtained. Nasal feeding was inaugurated after each operation involving the mouth cavity, and I wish to emphasize the importance of this method of feeding in similar cases, as feeding by mouth while the wound is fresh adds materially to the chance of infection, especially where there is so much difficulty in keeping the mouth clean.

On several occasions systematic attempts were made after dividing or removing the scar tissue to force the jaws apart by means of mouth-gags, wooden wedges, and screws, but they were only partially successful.

In a cursory glance through the literature I have not encountered just this method of utilizing the "flap from distant part principle" for closing a cheek defect.

The operations of Israel,¹ Hahn,² and Czerny³ are the only ones, as far as I can find, in which a portion of the same whole-thickness pedunculated flap is utilized to close both the defect in the mucous membrane and also in the skin. Israel secured his flap from the neck, Hahn from the chest, and Czerny from the cheek and neck.

All methods of closing such defects are tedious in their accomplishment, and this method is no more so than the

others, and has, I think, advantages which make it desirable.

By the method of treatment used in this case the defect was filled with a thick flap of tissue with whole-thickness skin on both sides. The circulation of the flap was assured before the transplantation was begun. Most of the shrinkage of the flap had taken place before it was transplanted. There was no unsightly scarring of the cheek or neck. The area from which the flap was raised was entirely healed by means of Thiersch grafts by the time the flap was ready for transplantation, and thus one chance of secondary infection was eliminated.

The only serious disadvantage of the method is the constrained position of the patient during the time the circulation from the cheek is entering the flap. This position apparently causes little discomfort after the first 48 hours. This patient did not even complain of soreness in the shoulder after the pedicle was amputated and the arm lowered to the side.

In a letter of recent date the patient says he is attending school and doing well. His appearance is so much improved that it causes him no concern. He can eat with comfort and pleasure, and is able to talk much plainer than before operation (Fig. 4).

On the whole the result is very satisfactory, although there is still limitation of the jaw movement. Furthermore, and most important, is the fact that the patient is relieved of a hideous deformity, which would have prevented his living a comfortable, healthy life, and would probably have interfered with his obtaining lucrative employment.

¹ Israel, J.: Arch. f. klin. Chir., Berlin, Bd. 36, 1887, S. 376.

² Hahn, E.: Verh. d. Deutsch. Gessellsch. f. Chir., 1887, 1, S. 102.

³ Czerny, V.: Beitr. z. klin. Chir., Bd. 4, 1889, S. 621.

TEMPORARY ARREST OF THE HEART BEATS FOLLOWING INCISION OF THE PERICARDIUM FOR SUPPURATIVE PERICARDITIS.

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No doubt, the rarity of an operation for suppurative pericarditis is sufficient to warrant its reporting. But, in addition to the surgical interest of this condition, the observation noted during the operation is a further reason for publication. This particular observation—temporary arrest of the heart on incision of the pericardium—may have a physiological significance, the importance of which, perhaps, has not been understood in the past, and the recognition of which may influence, in the future, the development of the technique of cardiac surgery.

The patient whose history is detailed below entered the Second Surgical Division of Fordham Hospital, in the service of Dr. William P. Healy, to whom the writer is indebted for the privilege of operating on and reporting the case.

History: The patient, a thin, poorly-nourished, anemic child, aged 11 years, was admitted September 10, 1912, to the Medical Ward of the Fordham Hospital, and on the same date transferred to the Second Surgical Division. Present illness began one week ago. Complained of pain in the left thigh, which has persisted. Swelling of the left thigh. No chill. Slight elevation of the evening temperature.

When admitted her pulse was rapid, weak, and irregular. Heart sounds weak and distant. Dulness, bronchial breathing, increased fremitus, and moist râles at left apex. Numerous moist and crepitant râles over left chest. Dulness, decreased fremitus, and diminished voice and breath sounds at base of left lung. Intensified breathing over the entire right lung.

Her abdomen was moderately distended. No mass can be felt. Liver, spleen, and kidneys not palpable. The left thigh is swollen, red, and tender. Deep fluctuation can be elicited. Temperature, 100 $\frac{2}{5}$. Pulse, 126. Respirations, 24.

Soon after the patient had been transferred to the surgical ward, the left pleural cavity was tapped and six ounces of turbid fluid obtained. A microscopical examination of this fluid revealed some pus-cells. No tubercle bacilli and a few Gram-negative staphylococci.

September 11, 1912.—General condition is somewhat better. The heart action is much embarrassed, the sounds being almost inaudible. A hypodermic needle was inserted into the pericardial sac and thirty minims of turbid serum obtained. Microscopical examination showed no tubercle bacilli. A cytological count showed polymorphonuclears, 49 per cent.; large lymphocytes, 33 per cent., and small lymphocytes, 78 per cent. The culture plates were contaminated. There was subsidence of the swelling of the thigh, though tenderness was marked. Temperature, 100 to 102. Pulse, 112 to 130. Respirations, 28 to 40.

September 12.—The cardiac impulse is neither visible nor palpable. Percussion shows the left border of cardiac dullness 11 centimetres from the midsternal line. Dullness is also increased to the right of the sternum. The sounds are more regular, though still muffled. Flatness and absent breath sounds over the base of the left lung. Increased breath sounds over left apex. The left leg is slightly cyanotic and the thigh swollen and tender. Temperature, 100 to 100 $\frac{4}{5}$. Pulse, 104 to 120. Respirations, 24 to 32.

September 13.—*Operation* (Dr. W. P. Healy): Incision and drainage of subperiosteal abscess of left femur. Ether narcosis. A vertical incision made on the inner aspect of the left thigh, a short distance above the knee-joint. The incision was deepened and a purulent collection encountered near the shaft. The bone was smooth and intact. Six packs of iodoform gauze were inserted and a dry dressing applied.

During the succeeding ten days the thigh wound drained freely. Her cardiac condition remained without improvement, with a tendency to become more accentuated.

September 25 (twelfth day *post operationem*).—The heart sounds are almost inaudible. The pulse rapid, weak, and irreg-

ular. There is dulness over the left lung posteriorly. The area of cardiac dulness is markedly increased. It is evident that there is both a pericardial and pleural effusion. Temperature, $100\frac{3}{5}$ to $102\frac{1}{5}$. Pulse, 118 to 130. Respirations, 28 to 40.

September 26.—Dr. A. F. Brugmann, after examining the patient, advised, as a preliminary measure, aspiration of the left pleural cavity.

This was done and twelve ounces of blood-stained fluid obtained. Slight improvement followed, but the cardiac embarrassment still persisted. Temperature, 100 to $101\frac{4}{5}$. Pulse, 92 to 132. Respirations, 30 to 56.

September 27.—Condition is poor. The pulse is very weak and irregular. Dyspnoea upon the slightest exertion. Extremities cold and cyanotic. Temperature, $100\frac{2}{5}$ to $100\frac{4}{5}$. Pulse, 98 to 134. Respirations, 40 to 60.

September 28.—Condition same as day before. Temperature, 100 to 102. Pulse, 130 to 160. Respirations, 44 to 66. The patient was brought to the dressing-room and the pericardial area painted with iodine; a medium-sized trocar and cannula were introduced into the pericardial sac, the point of entrance being in the left fifth interspace, one and one-half inches from the sternal border. Upon withdrawal of the trocar, purulent fluid was ejected under considerable pressure. Three ounces had been obtained when the flow ceased. It was apparent that more than simple aspiration was needed, hence operation was decided upon. The patient was returned to the ward and the operating room prepared.

Operation (Dr. A. H. Harrigan): Ether-oxygen narcosis. Dorsal position. The incision was four inches long. It began at the left sternal border and passed obliquely downward and outward, crossing the left costal cartilage at its centre. One and one-half inches of the fifth rib and cartilage were removed with the bone forceps. When the anterior mediastinum was opened several loud, hissing noises demonstrated that there had been an accidental laceration of the pleural reflection. A gauze packing was placed in the outer angle of the wound to prevent further entrance of air into the pleural cavity.

The pericardium was at least two inches distant from the surface of the chest. It appeared thickened and covered with a semi-gelatinous material. Several attempts were made to grasp

the pericardium with hæmostats so as to steady it before incision. Each time the hæmostats slipped. Finally, however, control of the membrane was secured and an incision two inches long made in the pericardial sac. Immediately upon opening the sac a large quantity of pus was forcibly ejected with a gush, forming a stream the height of which was at least two feet above the level of the patient. (Culture of this fluid showed staphylococci.)

Following this, the phenomenon mentioned in the title was noted. *The heart deeply placed within the pericardial sac lay absolutely motionless. No movement could be seen or felt. At the time of this observation an assistant palpating the radial artery could obtain no pulse. It was not determined whether the heart was in systole or diastole. The duration of this cessation of the cardiac action was not timed. Finally, when an attempt to introduce a gauze drain into the pericardium was made, the heart began to beat, and within a minute the action became tumultuous, causing the organ to spring forcibly against the chest wall.* After the introduction of the drain a voluminous dressing was applied and the patient returned to bed. The patient quickly recovered from the anæsthetic. During the remainder of the day and night the condition was satisfactory. The pulse was rapid but strong. Some restlessness at night required morphine. There was dyspnœa upon exertion. Camphor and digitalis administered.

September 29.—The external dressings were removed. They were saturated with thin, yellow pus. An examination of the drain and wound showed no blocking. Fresh dressings were applied. The camphor was discontinued and whiskey added to the digitalis. Her condition was the same as on the day of operation.

In the evening of this day the child's parents became very much alarmed about her condition and decided to move her to her home. This decidedly rash action met the earnest protestations of the house staff, but to no avail. Her parents moved the patient from the hospital to her home in the lower East Side of New York, a distance of at least nine miles, and among conditions decidedly prejudicial to her recovery. After staying there two days she was sent to Bellevue Hospital, where she died forty-eight hours after her admission.

In the absence of an autopsy it is impossible to speak

decisively as to the exact condition present. Reasoning, however, from the chain of clinical findings, it is extremely probable that the primary condition was a subperiosteal abscess of the femur, and the pericarditis was secondary, as the result of general sepsis. It is certain that the fatal outcome was hastened and perhaps aided by the premature removal of the patient during the most critical period of her illness. Possibly an earlier operation would have offered better prospects. A lesson learned from the study of this case is to use the exploring needle repeatedly as a diagnostic method if these cases are to be operated upon at a favorable period.

The fluid present, while not measured, easily amounted to a quart. The height to which it attained at the liberation indicated the extreme degree of intrapericardial pressure. That the pericardium may contain a large amount of fluid is explained by the softening produced in its walls by the inflammatory process. The sac, though normally resistant and elastic, becomes quite distensible.

The method of operative attack employed—simple resection of the fifth rib and cartilage—presents two disadvantages. The first is the indirect course of the drainage track, and the second consists in the liability of injury to the pleura. As a result of this technique, the resultant line of drainage passes from the pericardium obliquely forward and outward. This is objectionable. As mediastinitis is a frequent complication of suppurative pericarditis, it seems as though drainage directly forward through the mediastinum is indicated. Pleural injury seems extremely likely, for many of those who have studied the topography of the thoracic viscera (Dwight, Delorme, Sick, Quain, and Testut), agree that the reflection of the pleura and of the pericardium varies in many instances. An excellent discussion of the many operative procedures to expose the pericardium may be found in the monograph of Delorme and Megnoir.

Considerable discussion has centred around the relative position of the heart in the presence of a pericardial effusion.

In this instance the heart occupied a posterior position. This observation agrees with that of Eichel.

The striking feature of the operation was the peculiar and wholly unanticipated behavior of the heart when the pericardium was incised. The persistent "Stillstand" was indeed surprising. In order to determine whether this observation has been previously described, many case reports of operations for suppurative pericarditis as well as gunshot and stab wounds of the heart have been investigated. In several the reporters mention casually that a disturbance in the cardiac rhythm occurred when the heart was exposed; but none offered any explanation or even suggested that its occurrence may rest upon a definite physiological basis. In this regard the work of Heitler and Flint is of prime importance.

In 1910 Heitler published a *résumé* of his animal experimentation performed in Basch's Laboratory in Vienna. His article appears in the *Medizinische Klinik*, and is entitled: *Herzstörungen durch Reizung des Perikards. Vorschlag zur Kokainisierung des Perikards bei Operationen am Herzen*. Heitler noticed that as a result of electrical or mechanical stimulation of the pericardium in dogs marked irregularity in the beat of the heart occurred. Without detailing his experimental studies *in extenso*, it may be said that Heitler arrived at the definite conclusion that stimulation of the pericardium caused arrhythmia. In addition, he drew the deduction that the cardiac irregularity seen during the progress of pericarditis had its origin in irritation of the pericardium. Moreover, he recommended in operations upon the heart cocainization of the pericardium, preliminary to its incision, in order to prevent consequent interference with the heart action.

Heitler constantly uses the word arrhythmia in describing the phenomena noted. This term, of course, is vague, and offers no suggestion as to what mechanism or nervous reflex is disturbed. Heitler makes no attempt to explain the arrhythmia in the terms of the modern heart physiology.

Flint, in an article entitled "Physiologic Basis of Thoracic Surgery," confirms Heitler's work, but, in addition, maintains

that the arrhythmia is caused by a vagus reflex. Flint sums up thus: "The manipulation necessary for the incision of the pericardium manifests itself with perfectly typical cardiac inhibition, which lasts as long as the irritation of the pericardium continues."

As a matter of historical interest, it is significant to find that Ranvier, in his *Leçons d'Anatomie générale*, which appeared in 1880, refers to a contribution by Engelmann, published in 1875, describing the following experiments by Tagliani: The heart of a frog was stripped of its visceral pericardium, and it was then found that the myocardium no longer contracted on being touched with a needle on its denuded portion; it did contract, on the contrary, when it was stimulated at the points where the pericardium was preserved. Tagliani explained this observation by the presence of sensory nerves in the pericardium, the stimulation of these nerves acting upon the centre which produces the movement.

Engelmann repeated these experiments and arrived at different results. The interpretation of Tagliani was regarded by Ranvier as erroneous. However, in view of our present knowledge, the original observation of Tagliani as to the physiological relations existing between the pericardium and the myocardium apparently contained a germ of truth.

As a result of a study of the above references, it seems logical to assume to state that there exists a physiological association between the pericardium and myocardium, and that stimulation of the former causes a disturbance in the rhythmic activity of the heart. The exact relationship is unknown. In view of this, it seems fair to assume that the "Stillstand" of the heart noted at operation was caused by irritation—incision or manipulation—of the pericardium. It is apparent that the entire subject requires further investigation.

If this relationship between pericardium and myocardium be definitely established, then it will be necessary to revise the present technique of cardiac surgery.

MEMBRANOUS PERICOLITIS AND ALLIED CONDITIONS OF THE ILEOCÆCAL REGION.

BY JABEZ N. JACKSON, M.D.,

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To every surgeon probably has come once or oftener the humiliating experience of operating upon a patient for what he had carefully diagnosed as chronic appendicitis, only to find, after removal of the appendix, that the symptoms persisted without improvement. Ofttimes the primary operation has been supplemented by a drainage of the gall-bladder or, if the patient be a woman, by the removal of an ovary. And still the patient experienced no relief. Somewhat similar experiences have followed the surgical history of supposed gastric ulcer where gastro-enterostomy, in the absence of demonstrable pyloric obstruction, has proved so disappointing. To palliate our failures in these operations about the appendix, gall-bladder, and stomach we have been wont to fall back on the all-embracing diagnosis *neurasthenia*, which enabled the surgeon to smoothly edge from under the load of responsibility, but left the patient hopelessly mired in the slough of despond.

Such experiences naturally have been exceedingly distressing to the conscientious surgeon and have correspondingly stimulated our zeal in efforts to avoid similar errors and, better still, to discover some solution of our dilemma. Closer observation of pathological conditions, wider investigation of the accessory surgical field, and more exacting analysis of symptoms have thus become imperative. And to-day we are beginning to reap the fruit in the definition of other lesions which explain our former errors of diagnosis and point the way to possible rescue from despair of many of these unfortunates.

MEMBRANOUS PERICOLITIS.

In 1908 the writer presented to the Western Surgical Society some observations on certain pathological changes found about the right colon to which he applied the descriptive name "Membranous Pericolicitis," or the "Pericolic Membrane." These conclusions were the culmination of isolated individual observations of about six years. The first observation was made in 1902 in a case with the following history:

The patient was first seen by us when she was a probationary nurse in the University Hospital of our city several years before. We were then consulted for what was supposed to be an acute exacerbation of a long-standing case of chronic appendicitis. She gave the history of a number of previous attacks. In each case she had suffered from pain and distress over her entire right abdomen, though more particularly referred by her to the site of the appendix. In none of these attacks had she had temperature or pulse disturbances,—in fact, none of the characteristics of an acute appendicitis or peritonitis. She had gone to bed, however, frequently for a day just from pain and discomfort. She said that she had never felt entirely comfortable in her right side for years, but did reasonably well except when these severer "spells" came on. She was a very attractive young woman in her personality, and quite intelligent, though of a decidedly high-strung temperament and somewhat neurotic. She described her symptoms very freely,—in fact, was more fluent than is the average woman in portraying her complaints. We found her with a normal pulse and temperature. On palpation she complained of tenderness all over the right abdomen, was indeed quite hyperæsthetic. There was no rectus rigidity. Her greatest tenderness she located about the appendicular region in general, but we could not focalize to a finger-point. We fell in quite readily, however, with a diagnosis of chronic recurrent appendicitis and recommended operation upon her recovery from this "spell." There was no suggestion of urgency. When she got up, however, still being a probationer, the superintendent of nurses decided not to accept her in training, as she considered her too neurotic to make a satisfactory nurse. She therefore left the hospital, and we did not see her again for three or four years. She then came to Kansas City from her home in Iowa, where she had married and then lived, to consult us again. We then learned that in the interval she had been operated upon by a distinguished surgeon, whom we knew, and had had her appendix removed. She obtained no relief from the operation, however, and continued to suffer as before. A second operation was done and one of her ovaries removed. Still no relief, and with this history she returned to us. On examination, with the appendix and one ovary gone, we could find no explanation for her continued symptoms. She was

therefore referred to one of our leading internists, who sent her back again, saying that the other ovary was diseased and should be removed. We could not confirm this diagnosis, but she insisted on relief, and we consented to operate on the diagnosis of our medical *confrère*. Operation disclosed the one remaining ovary perfectly healthy. A perfectly healthy broad ligament was found on the side from which the ovary had been removed. We then decided to inspect the site of the appendix. Here we found a perfectly smooth cæcum at the site where the appendix had been with not the slightest adhesion of any kind. Above the appendix, however, indeed, really above the cæcum about the colon our attention was strikingly attracted to the condition with which this paper is concerned. Here we observed what looked like an entirely complete new layer of peritoneum, perfectly transparent, investing the colon from above the cæcum to the hepatic flexure. This membrane was very loosely attached, but moved freely over what appeared to be the normal peritoneal coat of the colon beneath. This membrane appeared to come on to the colon from the outer parietal wall, into which it quietly faded away and, above the hepatic flexure of the colon, became lost in the transverse mesocolon. The membrane covered also the whole of the circumference of the colon and imperceptibly became lost in the inner side of colon and the inner parietal peritoneum. The whole right colon was rather closely confined in the lumbar fossa and could not readily be pulled forward. Likewise it seemed distinctly shortened in its long axis and at places presented a pleating, with the delicate fibrous strands of the investing membrane passing straight across from one fold to the other. It thus appeared as though the colon was restricted both as to the action of its circular and its longitudinal fibres and more or less immobilized to the posterior abdominal wall. There were no adhesions between the colon and any contiguous structure, and the membrane did not strike us as analogous to an adhesion in any sense. It looked instead as we have described, as a new adventitious, vascularized, investing layer of peritoneum. At the time of this, our first, observation it impressed us as some sort of an anatomical freak which we in no way associated in our mind with the woman's complaints. We made no attempt, therefore, to deal with the membrane in any way, and, with the simple observation of its peculiar appearance, closed up the abdomen. The patient was, of course, not improved in the least by our operation, though we were satisfied now with a diagnosis of neurasthenia, and placed her malady in her head and not in her abdomen.

In the course of years, both before and since this case, we can recall several cases of somewhat similar clinical picture in which we have operated with a diagnosis of chronic appendicitis and removed the appendix—but without the expected relief to our patient. These cases, being always considered uncomplicated chronic appendicitis, were operated with a very

small abdominal incision, and the colon was not seen at all. The real condition in these cases is as yet conjectural, as we have had no opportunity to re-operate in any of them. In the light of other demonstrated cases, however, we now have a strong suspicion that this same pericolonic membrane could be found in at least several of them.

Following this interesting case, however, we operated in several cases of somewhat the same type, and with the diffused symptoms were in doubt as to whether the trouble lay in the appendix or the gall-bladder. In several such cases, in order to expose both sides through one opening, we made a free right rectus incision midway which could be enlarged in either direction as found necessary. This incision thoroughly exposes the ascending colon. In several of these operations we found both appendix and gall-bladder perfectly normal, but, to our surprise and interest, again observed this same peculiar membrane.

In review of these several observations we became convinced that herein lay a certain very absolute pathological condition of more or less frequent occurrence. We were sure that similar observations must have fallen under the eye of practically every surgeon of any considerable experience, though none, so far as we knew, had given it any special consideration in pathological description nor recognized it as a condition of any common occurrence or clinical significance. The only article bearing on this subject which had come under our attention was a brief one by our fellow-surgeon, Binnie, on "Pericolitis Dextra," undoubtedly referring to the identical condition, but viewing these changes simply as adhesions, as doubtless had the other many observers. This general conception had led to rather cursory attention, with the general assumption of antecedent appendicitis and the hope of relief by ordinary appendectomy. In our opinion, however, we had to deal with a condition of rather more definite pathological specificity, the exact origin and nature of which should become a matter of moment.

Pathological Description.—In 1908, at the Kansas City

General Hospital, we were fortunate enough to find a well-marked case in a patient dying of other causes, but with history of this type. This specimen was removed and submitted to careful examination by the pathologist, Dr. Frank J. Hall, who reported as follows:

"The specimen of ascending colon which you presented to me as a type of the pericolicitis you have been interested in exhibits the following gross and microscopic features: The specimen presents the caput coli with attached appendix, the ascending colon, and a short segment of the transverse colon.

"From a point just at the hepatic flexure to three inches above the caput there spreads from the parietal margin over the external lateral margin to the internal longitudinal muscle band a thin vascular veil in which long, straight, unbranching blood-vessels course, most of which are parallel with each other and take a slightly spiral direction over the colon from the outer upper peritoneal attachment to the inner lower portion of the gut, ending just above the caput. The appendix is not implicated in any way.

"Coursing with the blood-vessels are numbers of shining, narrow bands of connective tissue which gradually broaden as they go and end in a slight, fan-shaped attachment at various points on the anterior and inner surfaces of the colon. At these points of attachment the gut is held in rigid plication.

"The entire specimen conveys to the eye the idea that an œdematous fluid lies beneath this delicate membrane and reminds one of nothing so much as an œdematous arachnoid so often encountered on removing the dura mater from the brain of a dead alcoholic. The colon seems placed in a diaphanous bag slightly too short to contain it without wrinkling. At the beginning of the hepatic flexure the drawn membrane particularly angulates the contained tissue. Here and there are spots and tags of fat beneath the cobweb. On handling the specimen the colon slips about in its bag without entire freedom as a fetus within its amniotic sac. A portion of the parietal peritoneum has been removed with the colon, and shows that the membrane and blood-vessels arise in, and are continuous with, the structures of the parietal peritoneum as it sweeps over the colon. The entire structure seems to be peritoneum, loosened from its close connection to the abdominal wall and colonic surface by some serous exudate, after which the particular vascularization and connective-tissue banding has occurred as a chronic reaction to irritative influence.

"Microscopic sections prepared from blocks of tissue cut entirely through to the lumen of the colon present, first, a very loose external covering, a normal musculature, a broad submucosa, and a normal glandular coat. Our chief interest lies in the serous coat, which is seen to have its fibres split asunder as if by serous infiltrate, thus lifting the endothelial layer of the membrane, which is clearly demonstrated to exist as a cover-

ing for all. The blood-vessels present in cross section and are unusually large and thin walled. Wherever a blood-vessel courses there also is a condensation of the white fibres into bands parallel to the vessel. The general aspect of the region under discussion is that of a mass of more or less isolated fascicles of white fibrous tissue, with here and there a blood-vessel filled with blood, broad clefts lined with endothelium, and a few fat and connective-tissue cells sprinkled here and there.

"No fibrin, polymorphonuclear leucocytes, or other evidence of inflammation are present. The connective tissue next to the layer of longitudinal muscular coat is condensed, and seems to penetrate in increased amount between the muscle bundles. Aside from this questionable matter, the gut and its walls are normal. The endothelial covering in places on the surface is perfectly preserved, and demonstrated beyond a doubt that we have here no new or false membrane, but simply a rarefied and otherwise altered natural structure. The enlargement of the endothelial-lined clefts so abundantly observed suggests a chronic lymph-stasis as an associate condition, which is possibly a key to the formation of the amount of fluid in the tissue spaces of the peritoneum."

Clinical Description.—In addition to this description we would add some observations of the condition as observed now in quite a number of living subjects seen in the course of surgical operations. The transparent, vascularized veil appearance of the membrane strikes one's attention very forcibly with bright red vessels running parallel with the long axis of the ascending colon. In some instances it appears as though the membrane came on to the colon from the lateral parietal wall just above the cæcum and courses directly upward, to disappear beneath the liver on the superior layer of the transverse mesocolon. In other instances it seems attached to the under surface of the liver well anterior to the normal peritoneal reflection. Again, in other cases, it appears as though it had begun above and descended on the colon to its termination usually just above the cæcum.

Again we have seen it pass across and upward to the transverse colon, which in one instance was apparently drawn down by the membrane, practically paralleling the ascending colon to the level of the cæcum. (In this case the gastric symptoms were marked as a result of the mechanical gastropnoia thus produced.) In one instance this membrane was so dense as to lose entirely its apparent vascularity and transparency, and

looked like a solid sheet of organized fibrous tissue, beneath which the ascending colon was so lost that it could not be seen at all until the membrane was divided and brushed aside, when an apparently normal, though contracted, colon became evident. In one instance the membrane, passing from the colon across the posterior parietal wall, went as far over as the jejunum, which was likewise completely invested for about eight inches of its distance immediately after its beginning beneath the transverse mesocolon. In this case the symptoms had been quite strikingly those of pyloric stenosis, which was the pre-operative diagnosis.

In no instance does this membrane resemble our ordinary conception of an adhesion. It is never adherent to the abdominal wall nor to any contiguous loops of small intestine. Instead, it resembles more closely than anything we can describe a thin pterygium. In recent cases the membrane is quite free and produces but limited restriction to the underlying colon. In more advanced and characteristic cases it seems to bind the colon close to the posterior abdominal wall, and produces such marked angulations and convolutions of the colon as to practically produce a stricture of its lumen. In fact, in one of these cases seen in autopsy, when a stream of water was caused to flow into the cæcum through the ileocæcal valve, the cæcum distended almost to bursting, and yet none of the fluid would pass through the ascending colon and pass the hepatic flexure until it was milked through with the fingers. It is also noteworthy that in the large majority of cases the cæcum was not involved in the membrane at all, but is found greatly distended and correspondingly thin. Nor was the appendix invested except when it occupied an ascending position at the outside of the colon, when it was covered by the membrane as it was reflected on to the colon from the lateral parietal wall. The appendix in almost every case, however, was rather small and sclerotic. We have seen the membrane in one case in which there had been years before an appendicular abscess which was drained. In this case the cæcum was likewise markedly involved in the membrane. The angulation of the

colon is generally most marked at the hepatic flexure. There is always a very loose space where the membrane can easily be picked up at the outer angle where it passes from the colon to the outer parietal wall.

Etiology.—The cause or origin of this condition has given rise to considerable speculation, with a number of quite diverse theories. These varied theories resolve themselves naturally into three general theories: (1) congenital, (2) mechanical, (3) inflammatory, each with certain minor differences.

1. *Congenital.*—Quite a number of observing surgeons have expressed the view that the membrane described is congenital in origin, but differ as to the exact anatomical derivation.

(a) Mayo is inclined to view this membrane as the true peritoneum, which, as the cæcum descends, failed to settle itself closely in the normal way to the gut-wall, but, remaining loose, acquired the peculiarly excessive vascularization. If this were correct, we would wonder why similar peritoneal laxity did not extend to the cæcum as well.

(b) Keiller of Galveston, in personal conversation, suggested the possibility that this membrane was a prolongation of the border of the great omentum which became attached to the ascending colon while it was still up beneath the stomach before complete rotation and was drawn down over the gut in its descent and remained as a separate layer of peritoneum. His view was suggested by the parallel arrangement of vessels as in the true omentum and the fact that it appeared so often to come on to the ascending colon from above and was practically continuous with the right border of the true omentum. This theory has recently been supported in print by Cotte of Lyons, France, who considers it as *one* of the types of membrane. In cases, such as our first and others reported (one by Pilcher), where the descending portion of the transverse colon is drawn down parallel to the ascending colon and mutually covered by this membrane (double barrel, as Gerster describes), the suggestion looks plausible. We also have recently observed a case in which

the lower portion of the usual omentum was fused with the pericolic membrane for a width of about two inches just above the ileocæcal juncture, presenting a definite band of constriction, but free above entirely.

These congenital theories are attractive, and at the same time would offer the greatest encouragement to surgery. For, if such they be, a simple division of restricting bands, like tenotomy in congenital club-foot, should furnish relief, as should the method suggested by us in our original paper. However, so far we know of no observations of this condition in infancy or childhood. Furthermore, in all our cases the clinical history has been of adult origin. Perhaps, however, this can be explained by assuming that in early growth of the gut the membrane is sufficiently lax to permit freedom of peristalsis. Later on, however, as the gut grows in length or is lengthened by traction of the weight of stagnant feces, the membrane fails to stretch correspondingly, and hence begins to become a source of restriction and obstruction. Then follow the clinical phenomena.

(c) We have noted as one of the attendant conditions of our pathological picture the great dilatation, elongation, and thinning of the cæcum. As far back as 1904 Wilms of Germany called attention to a condition characterized by great motility and elongation of the cæcum, to which he applied the term "Cæcum Mobile," and to which he ascribed a chain of symptoms quite like those we have found in membranous pericolicitis. This condition of the cæcum is generally congenital, and, if the symptoms in our cases are due to the condition presented by the cæcum alone, we should recognize here likewise a congenital origin. Dreyer (Breslau), however, in anatomical studies found the cæcum freely movable in as large as sixty-seven per cent. of subjects, and hence questions the mobile cæcum in itself as a factor of much importance. In our observations we have been inclined to consider the enlargement of the cæcum as a secondary change, its gradual dilatation being the result of long-continued distention by gas and feces which are retained in the cæcum

owing to the obstruction in the colon above, caused by the restrictions of the pericolic membrane. Wilms, however, claims the existence of a symptom producing mobile cæcum without membranes, adhesions, or kinks. Such must be rare in our observation.

2. *Mechanical*.—All are familiar with the noteworthy and frequent papers of Arbuthnot Lane of London on "Chronic Constipation" and "Chronic Intestinal Stasis." Beginning with intestinal stasis, primarily dependent upon transition in man to the erect posture with evolutionary social changes and habits favoring stasis, Mr. Lane traces an extraordinarily interesting chain of sequences, both pathological and clinical. Among these pathological changes he describes adhesions about the terminal ileum, appendix, ascending colon, the hepatic and splenic flexures, and the sigmoid, all of which he considers as accessory ligaments formed to antagonize the downward strain, with tendency to prolapse of these segments of the intestinal tube. These adhesions, as described by Mr. Lane, are intended to be conservative and protective, though he admits they sometimes go too far and become obstructive. American observers have confirmed Lane's observations, practically concerning the kink (Lane's kink) near the terminus of the ileum and the adhesions (if such they be) about the ascending colon and hepatic flexure. His more elaborate or extensive descriptions have not often been verified, however, in this country. We are of the opinion, however, that what he has described simply as "adhesions" is, in fact, the same condition we have endeavored to present, though his observations have evidently been very lacking in descriptive significance and clarity. Likewise, while simple intestinal stasis may act in some manner as a cause in the production of these "adhesions," it is the "adhesions" which produce the suffering. Likewise, it may be pertinent to inquire if the "adhesions" may not, instead, be or become the cause of the stasis. At all events, we are persuaded that something definitely more than chronic constipation must exist to occasion either the pathologic or the clinical picture presented by

membranous pericolicitis. For all have seen the most stubborn and complete cases of constipation with no such pathological picture at all and oftentimes without any further clinical symptoms. We think this membrane is therefore something other than physiologic response to mechanical demand.

3. *Inflammatory*.—Two general theories of the origin, based upon the assumption of inflammatory origin, have been presented, one assuming a spreading peritonitis from points of original infection *without*, and the other a reaction from infection *within* the *contiguous* gut.

(a) *Without*.—Undoubtedly our older views of this condition accepted it as one of true adhesion, the result of old infection transmitted from, most usually, the appendix, or, in case of particular involvement about the hepatic flexure, from the gall-bladder; and upon this hypothesis it was confidently expected that the simple removal of the appendix or the drainage of the gall-bladder would suffice to cure. This surgical effort has proved a failure. This failure, however, does not suffice to disprove the theory, as the “adhesions” which are the effect of the original disease may suffice to become a secondary and effective cause of their own train of symptoms, and, even though the original focus is removed, this secondary cause remaining now becomes a primary source of importance. Hertzler, who also made microscopic examination of specimens from some of our earlier cases, believes the condition one of “varicosity of the peritoneum,” due to a more or less distant inflammation, and that the membrane (“pseudo-peritoneum”) itself consists of peritoneum mobilized by a hyaline degeneration of the subperitoneal connective tissue. The clinical history, however, does not show in these cases any sufficient evidences of a true peritonitis originating from a focus which would produce such broad results, apparently.

(b) *From Within*.—Perhaps the majority of surgical observers have held to the view that the peritoneal reaction is from infection within the colon. Gerster concludes that “the peritoneum reacts to the infectious process ordinarily associated with *chronic colitis* by the formation of character-

istic vascularized transparent membranes (pseudo-peritoneum) which take their origin along the external lateral aspects of the cæcum, ascending colon, and hepatic flexure on the one side, and the sigmoid flexure, descending colon, and splenic flexure on the other."

Pilcher, likewise, "considers them to be *the result of long-continued or oft-repeated mild infections of the peritoneal covering of the cæcum and appendix* transmitted through the intestinal wall," but does not specifically presume a colitis, as does Gerster.

The pathological report of Dr. Hall, quoted earlier in the paper, finds no microscopic evidences of change in the mucous or submucous coats to conform with the true colitis. When we reflect that the area of gut most affected is that from which most of the *physiologic absorption* takes place in the normal tube it is not difficult to assume that through this segment mild infection and toxins may likewise pass to the peritoneum without necessarily concomitant inflammation of the mucous lining, though the latter may, and doubtless often does, coexist. M. L. Harris is a positive advocate of the inflammatory theory, and believes that the anaërobic bacteria described by Runeberg and Keyde, which are always resident in this portion of the intestinal canal, are the specific factors in the production of the peculiar vascularizing inflammation characteristic of this pericolitis.

Our personal observation of now a considerable number of cases at operation rather inclines us to the belief that perhaps varied causes may be responsible for the production of this pericolic membrane. We have one case, previously reported, in which the membrane (in this case involving the entire cæcum as well) was undoubtedly the sequence of an antecedent acute peritonitis of appendicular origin. This case had been one of walled-in appendicular abscess, with drainage without removal of the appendix. At the time of our later operation all the walling-in adhesions were gone, but the vascular membrane was well marked. This is the only one of our cases with antecedent acute appendicitis. We have also seen one or two cases which strongly suggested a congenital origin

and verified a suspicion of the correctness of Keiller's (also Cotte's) omental idea. Also a few cases with alternating constipation and diarrhoea have led us to suspect a coincident colitis, as believed by Gerster. In quite the larger percentage of cases, however, we are of the opinion that the view suggested by Dr. Hall is correct. This opinion is the only one thus far substantiated by microscopic study including the entire gut. We do not assume, however, that one can be dogmatic concerning the revelations of only one case of real pathologic study. Surely, however, surgery here presents a definite problem worthy of the extended studies of the pathologist, whose aid must be invoked in the solving of the question of pathogenesis, since upon this solution may rest in such large measure the correct direction of surgical effort.

Symptomatology.—While the observation of our early cases was producing certain fixed opinions of a definite pathology, we were also, in the study of the clinical manifestations gradually, greatly impressed with certain striking similarities in the clinical histories of each. These impressions were remarked to several of our surgical colleagues, and, becoming likewise interested in the subject, they were soon able to confirm both the pathological picture and the clinical syndrome. Finally, from these repeated personal observations, and with the assurance offered by the corroborative evidence of these colleagues, we became convinced that this interesting pathological condition should be susceptible of absolute clinical diagnosis. Finally, in the early part of May, 1908, came the first case in which we attempted to make such a diagnosis before operation. This diagnosis was fully confirmed when the abdomen was opened. Between this time and that of the publication of my original paper in March, 1909, we operated upon nine cases in which this membrane was found, and in no case where such diagnosis had been made did we fail to find the corresponding pathological picture. This clinical report of several of these cases was given in detail in our original paper and will not be repeated here. These conclusions have been further confirmed by an experience in the observation of, at the present, in all, about thirty-five cases. We feel, there-

fore, that this positive pathological condition has an equally positive clinical picture. The following symptoms combined are usually sufficient to establish a definite clinical syndrome:

1. *Pain*.—In every case pain has been the dominant symptom which has caused the patient to be referred to us for surgical relief, usually in the belief that the patient was suffering from appendicitis or gall-stones or, in several instances, gastric ulcer. This pain practically always has at some period a definite abrupt onset. Sometimes the pain is quite severe, sometimes no more than distinct distress. When once started the case is usually distinctively progressive in its development, though oftentimes, in the early stages, with remissions of comparative comfort for variable periods. Later the pain or discomfort is practically constant, though marked by periods of acute exacerbations ("spells"), oftentimes requiring morphine for relief. The pain is quite generally diffused over the entire right side of the abdomen, though oftentimes particularly accentuated over the cæcum and at the hepatic flexure beneath the ribs. These several attacks of pain are not, however, as a rule, attended by any elevation of temperature or by any pulse disturbance. They are rarely, if ever, referred to the epigastrium.

2. *Tenderness*.—A *diffuse tenderness* is likewise characteristic, but *without any attendant rectus rigidity*. This tenderness oftentimes approaches an hysterical *hyperæsthesia*, and may be such as to render the pressure of clothing quite unbearable. While, like the pain, the tenderness is diffused pretty well over the entire right side of the abdomen, particular points are frequently observed low down in the groin, at McBurney's point, and just beneath the costal margin. These particular points of tenderness generally lead the practitioner to refer the case to a surgeon with a diagnosis of either ovarian trouble, chronic appendicitis, or gall-stones—or a combination of each. The *distinctly localized* symptoms of these varied conditions, however, are lacking.

3. *Constipation*.—Constipation is marked, particularly in well-developed cases, and large doses of any cathartic are required to secure evacuation of the bowels. The thorough

emptying of the gut, however, oftentimes affords distinct but transitory relief. Castor oil usually cures for a few days. In some instances the constipation has existed long before the pains began, sometimes there was none before. It is certainly exaggerated after their onset.

4. *Bloating by Gas*.—The formation of gas with much bloating is usually a marked symptom, particularly in the periods of exacerbation. This bloating is most marked in the lower abdomen, and is due to the great distention of the cæcum. It tends to grow worse and in itself causes much distress, and the patient complains much of the constriction of clothing. This gaseous distention of the cæcum is oftentimes sufficient to be apparent to the eye in inspection of the abdomen. On palpation the fulness is evident, and gurgling is readily demonstrated by manipulation with the fingers. Sometimes relief is experienced by pressure over the cæcum, as in leaning against a table or bed or lifting the lower right abdomen with the hands. Sometimes, under such manipulation, the gas can be felt to pass onward with corresponding relief. Abdominal massage properly used may give temporary relief.

5. *Mucous Diarrhœa*.—In long-standing cases constipation may alternate with mucous diarrhœa. In nearly all cases some mucus will be found on examination of the stools, but is usually not sufficient to attract the attention of the patient, and the fact is only elicited on direct inquiry.

6. *Gastric Disturbances*.—Disturbances of digestion are rarely absent, and are oftentimes so pronounced as to make them dominant and lead to a primary diagnosis of "chronic gastritis" or "gastric ulcer." They are not influenced by diet or even, as a rule, by fasting. They have no definite relation to the period of gastric digestion, and are only benefited by purgation, and then but for a while. The gastric analysis is likewise variable. In all, these stomach symptoms conform with what we to-day generally recognize as those of functional gastric disturbance, with the real disease elsewhere. In this connection it is well to quote from a recent address of Moynihan where he says, "In my own experience the commonest

site of a 'gastric ulcer' is in the right iliac fossa, and I have no doubt that in the majority of the cases which form the basis of the text of the very careful and elaborate treatises by the physicians of all lands upon 'gastric ulcer' no morbid process of this kind was present."

7. *Loss of Weight and Tone*.—As the case progresses the patient begins to exhibit the usual signs of intestinal toxæmia, with general impairment of nutrition and vitality. He begins to lose flesh quite perceptibly, and with the loss of weight is a corresponding loss of strength and tone. He becomes weak and lacking in ambition, the skin becomes mottled and discolored, the facial expression shows depression, and the general picture of intestinal auto-intoxication is complete.

8. *Neurasthenia*.—Finally, the patient becomes markedly neurasthenic and even melancholic. All symptoms are exaggerated, and it would take volumes to record their chronology of complaints. When our surgical efforts proved futile it was easy to fall back on the all-sufficient excuse, neurasthenia.

Differential Diagnosis.—We believe a diagnosis can almost always be correctly made by a careful study of the case under the analysis of the foregoing symptoms, particularly after one has once had the experience of even a few well-observed cases. Thus far we have found little difficulty in diagnosis through the analysis of the clinical symptoms and physical examination alone. In fact, we have been able to arrive at a positive diagnosis in all well-matured cases on clinical evidence alone, and in no case in which such diagnosis had been made did we fail to find the membrane. It is, however, true that the membrane, in several instances, has been discovered in the course of abdominal work for other conditions where it had not been suspected. In none of such cases, however, was the membrane producing any mechanical interference with the free action of the colon. It is therefore apparently only productive of diagnostic signs when it has become a factor in the establishment of mechanical interference with intestinal peristalsis.

For additional evidence the use of the X-ray, following the ingestion of bismuth, has proved of considerable value, and

has been well presented by Lane, Pilcher, and others. For the technic of this use of the bismuth meal we quote as follows from Pilcher:

"Technic of Bismuth Meal.—The bowels having been emptied during the day by a dose of castor oil, the patient is given, at ten o'clock in the evening, a mixture containing from two to four ounces of bismuth subcarbonate, the amount to be determined by the size and weight of the patient. To this are added six ounces of mucilage of acacia, and the quantity thus obtained made up to sixteen ounces by top milk, which serves to disguise the insipid taste of the bismuth and the acid taste of the acacia. The patient then reports to the radiographer the following morning at nine o'clock, after an approximate interval of twelve hours, at the end of which time it will usually be found that most of the bismuth emulsion has passed the terminal ileum and has already filled the first part of the big gut. Subsequent exposures must be determined according to the degree to which the bismuth is found to have progressed along the bowel at the first examination. In many cases a supplementary enema of bismuth is administered through a short rectal tube. Observation shows that the emulsion is carried around to the cæcum within four or five minutes by retrograde peristalsis. By combining the two methods a good demonstration of the entire intestine can be secured."

The evidences furnished by skiagraphic work with bismuth are in general those of local stagnation in the ileocæcal region, and particularly will demonstrate the dilated and oftentimes pro-lapsed cæcum. Repeated pictures at intervals also demonstrate the retardation of the fecal current in the ileum, in the cæcum, at the hepatic flexure, or anywhere that obstruction may occur.

With the rather broad distribution of symptoms resulting from membranous pericolicitis there may be quite a number of other conditions simulated and require differentiation.

1. *Chronic Appendicitis.*—The most common error has arisen in diagnosing this condition as chronic appendicitis, a mistake often made, indeed. It should be remembered, however, that the appendix, as a small localized organ, should give, when inflamed, rather correspondingly definite local signs. The tenderness of chronic appendicitis can, even by the patient himself as a rule, be focalized with the finger-tips, though the exact spot must vary with the anatomical site of the appendix in the individual case. In membranous pericolicitis, in marked contrast, the tenderness is diffuse, as the lesion, over practically the entire right side

of the abdomen. It cannot be covered with the finger or even the hand, but the patient, in endeavoring to signify the site of pain, passes his fingers from costal margin to Poupart's ligament. It is true that he will usually in time find spots of rather exaggerated tenderness, as at McBurney's point, due to the distention of cæcum, and beneath the costal margin where is found the hepatic flexure as well as the gall-bladder. But these are not distinctly focal points of focal disease. An attack of acute appendicitis with diffuse peritonitis leaving behind extensive adhesions might produce similar signs of diffuse pain and tenderness, but in membranous pericolitis there is never any history of such antecedent acute appendicitis, no fever, no rigidity, no tumor, no prolonged acute bed illness. Furthermore, in the true chronic appendicitis the pain is in most instances referred to the epigastrium, and the local signs of appendicitis become well marked only when the inflammation is sufficiently acute to extend to the peritoneum. In membranous pericolitis the pain is always distinctly confined to the right side of the abdomen, and is never epigastric. There may be many stomach disturbances, but rarely gastric pain. This significance of epigastric pain in chronic appendicitis is indeed noteworthy. Stanton, in the analysis of end results in a traced series of one hundred cases operated upon for presumably chronic appendicitis, remarks, "in our cured cases of chronic appendicitis the pain has been almost constantly referred to the epigastric or mid-abdominal rather than to the right inguinal region. On the other hand, nearly all the patients not benefited by operation complained of right inguinal pain as one of the chief symptoms."

2. *Gall-bladder*.—The diagnosis of gall-bladder disease has also been one of the sources of error. The marked angulation of the hepatic flexure and the pain occasioned as intestinal contents attempt to pass this point of narrowing suffice to explain the confusing symptoms. Of course, there is no jaundice and no true biliary colic. But even so these signs may be lacking in true gall-stone disease. But the one significant point is the absence of distinct localized exclusive pain or tenderness beneath the ninth costal margin, which should be distinctly focal in cholecystitis, but is diffuse in pericolitis; also, there is seldom transmitted subscapular pain in this condition.

3. *Gastric Ulcer*.—The diagnosis of gastric ulcer has also been made, and, indeed, often strongly claims one's attention, in view

of the almost universal presence of digestive disturbances in these colonic disorders. In pericolitis, however, the gastric symptoms present no definite type, and have no special relationship to gastric function, either in time of occurrence or in character. They are only influenced by intestinal evacuation. The present-day conception of extrinsic gastric symptoms, and reference will readily protect the careful analyst, with the presence of the other distinctive intestinal signs.

4. *Ovaries*.—In women the cæcum distended and down low in the pelvis leads one to consider ovarian disease, and doubtless many ovaries have been taken out on such erroneous conclusions. Again, however, we must note the absence of focalizing limitation or association with menstrual function, and pelvic examination should clear remaining doubts.

5. *Chronic Colitis*.—The term colitis as used in the past has been so all-embracing as to cover every phase of large intestinal activity, and doubtless many cases of membranous pericolitis have found refuge beneath its sheltering wing. A true colitis, however, should show more evidences of increased mucous secretion. Diarrhœa, therefore, should be largely characteristic of colitis, with abundance of mucus in the stools most of the time. In membranous pericolitis, *per contra*, diarrhœa is absolutely rare, and mucus is only observed on close attention and then fixed to the fecal mass. In the opinion of some observers, colitis is a cause of the pericolic membrane. We rather incline to doubt this, but believe that, as the result of chronic retention and irritation in the gut restricted by the pericolic membrane, a colitis may occur as a secondary condition; and, furthermore, these cases have proved in our experience most resistant to treatment.

6. *Lane's Kink*.—The distinctly focal observation in the terminal ileum produced by the much-discussed Lane's kink may also be a source of confusion. When Lane's kink is found as a solitary lesion, however, the broad distribution of signs presented in membranous pericolitis is lacking. In fact, Lane's kink more nearly simulates a true chronic appendicitis, as it is likewise a distinctly localized process. It is usually referred a little lower down and more toward the middle line than the appendix, but the X-ray may be required to differentiate. The Lane's kink may, however, be associated with membranous pericolitis. When so associated it cannot at all be diagnosed in advance, but as a

possible factor should always be looked for when operation is undertaken for the broader condition.

7. *Kidney Stone*.—Kidney lesions, and particularly calculus, may occasionally be suggested, though such has never occurred in our cases. The urinary analysis and the X-ray findings are sufficient to dispel any doubt.

One fact at least has been clearly demonstrated. In cases of any surgical doubt of diagnosis a sufficient exposure should be made to disclose the entire ascending colon, which should then be systematically explored. The small incision and the too hasty operation on too confident diagnoses have been factors which have led us into many distressing failures. If we progress no further from these studies of membranous pericolicitis than to enable us to avoid previous errors in diagnosis and correspondingly fruitless surgical efforts we shall have gained much. With this more accurate study, however, as a basis, may we not look forward to ultimate surgical achievement in cure?

Treatment.—From what has been said as to the quite varied opinions expressed concerning the etiology of this condition, it might reasonably be inferred that the views of treatment would be equally divergent. And to one who has followed the rather extensive literature of the subject within the past year this variance becomes evident. And such is but to be expected in any new field of investigation. We are frank to confess that our own personal opinions are as yet undecided, and only with time and an honest and impersonal criticism of actual experiences can the true condition be obtained.

1. *Non-surgical Treatment*.—We have, as before stated, observed this apparent membrane in several instances with relatively slight symptoms; and in these cases the membrane was evidently producing no mechanical interference with the gut activity. These observations lead us to believe that possibly some cases, particularly those in which an early diagnosis can be made, may be cured by proper treatment without resort to surgery. And particularly would this inference appear correct if we accept the view of a colitis or an over-

absorption of irritant toxic or infective material in the colon as the beginning point of the disease. Upon this presumption the logical non-surgical treatment would involve: (1) the proper drainage of the large intestine and the removal thereby of causative factors; (2) the establishment of a correct dietary to eliminate factors of fermentation, putrefaction, and irritation; (3) methods for development of normal evacuant capacity of a gut whose muscular tone is impaired or interfered with—as by massage and exercise; (4) direct medication of the colon, mainly through colonic lavage, aided by varied possible specific medicinal agents; (5) external supports to correct malpositions and obviate the stasis of gravity.

Tyrode of Boston reports a series of cases of clinical history analogous to those found in the early stages of this condition, which under systematic treatment along such lines were greatly relieved or cured. For details of such treatment we refer one interested to the complete description of Tyrode. We are particularly inclined to emphasize the importance of efforts to restore normal muscular tonicity. Cathartics, while occasionally required, are in the end only a makeshift. Correct massage of the colon to aid evacuation of the gut and at the same time to restore muscle tone is of much value. Likewise we consider valuable exercises which bring into use the abdominal muscles and render them auxiliaries to those of the intestine. In fact, we are of the opinion that the sedentary habits of modern civilization, with the negative assistance of relaxed abdominal walls on a comfortable seat in the modern closet, are potent factors in the general tendency to constipation. The relatively weak involuntary muscles of the intestinal wall were never intended to do the entire work in producing evacuation of the intestinal contents. The compressive action of the abdominal muscles must be brought to their aid, and therein lies an important element in any non-surgical treatment. Where the factor of ptosis is added, proper abdominal support, as emphasized by Franklin Martin, is obviously valuable, but should not be carried to such an extent as to interfere with the proper activity of the abdominal muscles. Hot-water flushing of the colon not only removes toxic

material and products of putrefaction, but is furthermore stimulant to correct glandular secretion and intestinal motility. We have not considered added medication of these colon flushings as of much added value, as there is so seldom much mucous discharge in typical cases.

Surgical Treatment.—In our experience most cases have been treated for rather prolonged periods, oftentimes even for years, before surgical advice is requested. Such evidences would not lead to much enthusiasm for conservative treatment in the average case. In fact, most of our patients have progressively grown worse, even in the face of prolonged medical efforts. And, indeed, when one views the extensive pathological changes on the outer gut surface in typical cases, one could not well hope for any real curative results from any internal medication. When fully developed it is apparent to anyone who has seen a case that the cure must be mechanical and thus require some form of surgical intervention.

But here, likewise, we are confronted with considerable disagreement of surgical opinion in keeping with the divergence of pathological conception. In order to fully comprehend the situation it is well to view briefly these varied surgical procedures. Several of these procedures have been suggested for presumably quite different conditions, but, we believe, have covered conditions of membranous pericolicitis and add some information to the subject.

We have expressed the opinion that Mr. Lane has covered the same subject in large measure from a different viewpoint. Considering intestinal stasis in the colon as the starting-point of all trouble, Mr. Lane has directed his surgical efforts to the end of sidetracking the main portion of the colon and permitting a shorter and quicker outlet for intestinal waste. It is evident that in his opinion the individual would be better off without the colon altogether. His first efforts were directed, however, to a simple short-circuiting by ileocolostomy. From this he derived much benefit, but not complete satisfaction. The well-known fact of reverse peristalsis in the colon would still carry contents back into the segments which he desired to exclude. He then began the plan of

supplementing the ileo-sigmoidostomy by excision of greater or less segments of the remaining colon, and a few years ago advocated the radical excision of the entire colon from the ileocæcal juncture to the sigmoid. This radical suggestion met with little acceptance elsewhere on account of its apparent magnitude. And now Mr. Lane has himself abandoned the plan on account of several instances of distressing after-effects and an excessive mortality, mainly from true adhesions. In his latest communication he has returned to the simple ileo-sigmoidostomy, now supplementing it, however, by an effort to establish a new and artificial kink above his point of anastomosis to prevent reverse peristalsis carrying the feces back to the right colon. This method has not long been used, and his ultimate experience with it is yet conjectural. If it is successful in preventing reverse peristalsis, the question naturally arises, may we not pass from constipation to diarrhoea, and, if so, where are we better off? With effective cut-off of reverse peristalsis, the further question of nutrition arises, with so large a part of our food products excluded from the absorption of the first portion of the colon, and, instead, rejected promptly from the anus. In all, the method of Mr. Lane has never appealed to us sufficiently to warrant our giving it a trial, though unquestionably some good and satisfactory results have been reported by Mr. Lane, and also by others who have followed his lead.

For a good many years cases of various types of chronic colitis have been treated by *cæcostomy*, as recommended first by Gibson of New York, or by *appendicostomy*, a modification of Gibson's idea introduced by Weir, also of New York. Through a fistulous opening thus provided the gut could be directly treated by irrigation, supplemented with such local agencies as might be indicated. Many most satisfactory cures have been reported from such treatment. If the theory of Gerster as to the origin of the pericolic membrane from a primary chronic colitis is correct, then this might logically have a place here. In critical reviews of the results of cæcostomy and appendicostomy, however, one is struck by the rather frequent occurrence of such remarks as this: "The

patient was entirely relieved until the fistula was permitted to close, when the symptoms recurred"; or "the patient will not permit the fistula to close." Is it not highly probable that these cases of supposed chronic colitis were indeed ones of pericolicitis instead? The vent which relieves tension could thus afford relief while maintained, but with the pericolic membrane still present, a recurrence of symptoms would be inevitable when the vent was closed. It is evident, hence, that a simple cæcostomy would not cure membranous pericolicitis. But if this operation were preceded by methods which would secure removal of the constricting or restricting membrane (the sequence of colitis, if this theory is correct) it might offer a logical method for curing the original colitis. While this procedure has never been adopted by us, largely alone because of the objectionable fistula, it may yet become a method worth serious consideration.

Viewing the dilated and mobile cæcum as the fundamental cause of the symptoms presenting, Wilms, years ago, suggested a *cæcoperxy* as the correct treatment. This operation was designed to fulfil two functions: (1) to elevate the prolapsed cæcum out of the pelvis, and (2) to fix it so as to prevent kinking in peristalsis and likewise to relieve tug on bowel and appendix. This procedure has been utilized in quite a considerable number of cases by Wilms and others in Germany, with approximately seventy per cent. of cures. Wilms's method was to fix the cæcum in a pocket of peritoneum made just about the brim of the pelvis, into which the lower end of the cæcum was slipped. To this method, in women at least, objection has been made by a number of obstetricians on the ground that thus placed it would become the source of trouble in pregnancy from pressure of the uterus thereon, as well as by the limitation of upward lift of the cæcum, which should take place as the uterus ascends. Others have suggested instead its fixation to the anterior parietal wall. Gregory Cornell, who has followed our suggestions of stripping off the investing pericolic membrane, has left this membrane attached to the cæcum at its lower end, and twisting the membrane into

a cord has brought it through the parietal wall as a ligament of suspension.

Other German surgeons, believing the dilatation rather than the mobility of the cæcum to be the productive factor, have attempted to correct the condition by *plication* of the cæcum instead, on the same principle which has prevailed in plication of other dilated organs, such as gastro-plication, for the stomach. This has really seemed more logical to us than the fixation method of Wilms, though, indeed, both might be combined.

If our view is correct, however, that the dilated cæcum was a secondary matter, the result of long-continued distention resulting from the restriction of the pericolic membrane above, we would naturally expect the results of either of these methods alone to be transitory, and that with the cause remaining a recurrence of dilation would be inevitable. We would like, therefore, to know the remote results of such measures alone before accepting them as logical surgical procedures.

We are, however, inclined to consider some such procedure a valuable step in the mechanical relief of the obstructive effect of the pericolic membrane. When this is accomplished, the secondary dilation of the cæcum should be attacked, for we believe it to be a distinct factor in the ultimate cure. We look upon the cæcum in many respects as the initial propeller in the colonic circuit. With obstruction in front, the cæcum becomes so stretched as to lose its tone and finally its function. Cannon has demonstrated that the colonic muscles in a normal condition of tonus respond to the presence of material within its lumen by the reaction of peristalsis. When, however, the tonus of the muscle is lost, as by overstretching, the peristaltic reflex disappears. The obstruction which produced the dilatation should, hence, be first overcome. Otherwise, even though cæcoplexy or cæcal plication for a while might be efficient in restoring normal tones, we would naturally expect, with the original factor still present, a recurrent dilatation with all its sequelæ.

On the other hand, with the removal of the obstruction

alone, we yet leave a dilated cæcum with deficient primary propulsion of the fecal current. Hence this method alone will likewise sometimes fail. And such has been our experience. In our original operations we limited our surgical efforts to the removal of the constricting effect of the pericolic membrane which we attempted to remove entirely. In about 75 per cent. of our efforts the result was entirely satisfactory, with complete relief. In a smaller percentage we secured benefit in part, and in a few cases no benefit whatsoever. The latter cases were usually of long standing, and the dilatation of the cæcum was well marked, with considerable bloating and oftentimes with occasional diarrhœa. Believing that the condition of the cæcum was perhaps the cause of our failure here, and recalling the experiences of Wilms and his followers, who secured about the same percentage of cures from cæcopexy or cæcal plication alone, it occurred to us that our original efforts might be supplemented by this procedure with advantage. Of these two German methods, plication has seemed to us to be more logical. When properly done it secures a shorter length of muscle action, thereby restoring tonus and with it the initial peristalsis so necessary. This plication can be accomplished either by longitudinal reefing mattress sutures, usually one paralleling each longitudinal band, or by two or three series of transverse sutures turning in each a fold of about one-quarter inch depth. These sutures are planned to pick up the muscular coat as well as the serosa, and as material we have used linen. This combined procedure we have utilized now for nearly a year in about ten cases, and with apparently, thus far, perfect success.

One further word here may be spoken concerning the method of dealing with the obstructive membrane. Most of the surgeons who have given attention to this condition have contented themselves with simply dividing the bands at the points of particular fixation, stretching them apart and in some instances doing plastic suture to cover the resultant raw surfaces in some manner to prevent adhesions without at the same time restoring the constriction. And in general they have reported good results from this method. In our original

communication we suggested the more complete removal of the entire membrane, which is easily accomplished. Of this method the theoretical objection was offered that it would leave large raw surfaces which might invite adhesions. On likewise theoretical grounds we assumed that the remaining covering of the supposed raw surface represented an epithelial lining of lymph space which could take the place of the normal peritoneum. Since our original communication we have operated upon two cases in our clinic where other surgical conditions of the abdomen were known to coexist and were left for future operation in order to afford opportunity for observation of the effect of the colonic stripping. These two cases, when re-operated at the end of six months and one year respectively, showed no adhesions whatsoever, thus apparently justifying our theoretical assumption. The primary effort, however, is to relieve restriction, and the extent of dissection of the membrane should be governed by this necessity alone.

In some cases the angulation of the hepatic flexure is particularly marked, and the obstruction is found chiefly here. Likewise in these cases the pericolic membrane is particularly dense and extensive. In such cases particularly the suggestion of Hoffmeister is worth consideration. He has resorted to a lateral anastomosis between the ascending colon and the descending loop of the transverse colon, thus affording a new and satisfactory channel for the easy and complete emptying of the stagnant ascending colon and cæcum. Where such an object appears desirable it has occurred to us that a method similar to that of Finney's pyloroplasty applied at the hepatic flexure would be particularly adaptable. Thus far, however, we have not had occasion to try it, but expect to when a suitable case presents.

In one instance at least, reported in our original communication, the membrane was a solid sheet of fibrous tissue perfectly opaque and entirely obscuring the entire ascending colon and hepatic flexure, which could not be recognized at all until the membrane was divided and stripped away. Then we discovered a small contracted atrophied colon which we believed incapable of restored function. In this case we excised the

entire ascending colon, including the hepatic flexure, and made an anastomosis between the ileum and transverse colon, thus entirely curing our patient. Occasionally it may be necessary to repeat such a procedure.

Finally, we are of the opinion that no one method will be found applicable to all cases, and that it is well to have in mind all the varied methods enumerated. A judicious surgical selection will give better results than any one method followed as routine. In the majority of cases the removal of the obstruction of the pericolic membrane, supplemented by a cæcal plication, is our present method of choice. In more advanced cases some method of direct drainage, as by a plastic anastomosis at the hepatic flexure, will be preferable, and occasionally a more radical operation, as excision of the ascending colon, may become necessary.

In conclusion we desire to emphasize, as we did in our first article, that any surgical procedure must be followed by a vigorous after-treatment along general lines before indicated. Correction of diet, regulation of habits, muscular exercise, and abdominal massage, with colonic lavage occasionally, should be considered essential factors in restoring proper tone and function to an intestine long disabled.

Since completing the above article, a new method of short-circuiting the colon has been suggested by Dr. Frank C. Yeomans, of New York City, in the *American Journal of Surgery*, January, 1913. Yeomans makes an anastomosis between the cæcum and sigmoid (cæcosigmoidostomy). With the usual mobility of the sigmoid and the elongated cæcum, an anastomosis of this type is easily effected, as judged by his experiences in three cases. This method appeals to us as superior to that of ileosigmoidostomy as it provides free drainage to both ends of the short-circuited colon. Even should reverse peristalsis carry fecal contents back around into the cæcum, it would again drain out through the anastomosis into the sigmoid and not invite recurrence of stasis in the cæcum and ascending colon. Theoretically, we are much impressed with this technic if any short-circuiting is demanded.

CARCINOMA OF THE PAPILLA OF VATER.

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PRIMARY carcinoma of the duodenum, while not being of sufficient rarity to be in any sense classed as a pathological curiosity, is nevertheless extremely infrequent in occurrence as compared with many other forms of cancer. Thus, Geiser reports that in a series of 5865 autopsies on *cancer patients* the duodenum was affected but 23 times, or in about 0.4 per cent. McGlinn found in going over the records of the Philadelphia General Hospital that in over 9000 autopsies there was but one instance of carcinoma of the duodenum, and Sears, in 1904, reported a carcinoma of the papilla of Vater as being the first example of that condition ever found in the autopsy room at the Boston City Hospital.

The large majority—about 70 per cent.—of all carcinomata occurring in the duodenum are located at the papilla of Vater, and possess, therefore, greater clinical interest than their relatively infrequent occurrence would indicate, owing to the great physiologic importance of this portion of the intestinal tract. So long as this region was considered a *noli me tangere* from the operative stand-point, carcinomata in this locality possessed more of a purely pathological than surgical interest, but in view of the fact that within the past few years over 20 cases have been reported, in which attempts at the radical extirpation of such malignant tumors have been made, apparently followed in a few instances by permanent cure, this can no longer be considered true, and any case which has a bearing on the subject would seem worthy of report. The following case came under the writer's observation through the kindness of Dr. Theo. A. Erck, at whose request the autopsy was performed. I am indebted to him for the privilege of reporting it, and to Dr. W. H. Fritts for the clinical notes.

Mrs. G., age sixty-five years. Aside from rheumatic attacks at times, patient enjoyed good health until August, 1909, when she complained of a "bilious spell," with lassitude, and severe pains in the back, gall-bladder region, and left arm; this was accompanied by distinct jaundice. Her condition improved somewhat, but in January, 1910, she had a recurrence of the same symptoms, and again in October, 1910, from which time the jaundice steadily increased until her death in May, 1911. She complained a great deal of "indigestion," and during the latter part of her life was able to eat very little, but was comparatively free from pain. In April, 1911, she went to the Hahnemann Hospital; at this time a distinct mass was palpable below the right costal margin. The surgeons at the hospital advised operation, but this she refused and returned home. From this time on she steadily went down hill; during the last week she was in a state of extreme exhaustion, and had a number of convulsions, associated with nausea and great thirst.

Autopsy.—Body considerably emaciated; skin everywhere of a deep bronzed color. On opening the abdomen a large amount of bile-stained, ascitic fluid escaped. The liver, gall-bladder, stomach, duodenum, and pancreas were removed *en bloc*; no changes of importance were found in the other organs. The liver was rather hard and deep yellowish-brown in color. The gall-bladder was the size of a large orange, thin walled, tense. On being opened, it was found to contain perfectly clear, mucoid fluid, and a single gall-stone, about the size, shape, and color of a large olive. No trace of the cystic duct could be found, it evidently having undergone complete obliteration.

The stomach was opened by an incision along the greater curvature, which was continued through the pylorus and throughout the duodenum. Some slight difficulty was experienced in locating and passing a probe through the papilla of Vater; this was finally accomplished, however, the probe meeting with a slight resistance at the entrance to the duct. The latter was slit up throughout its entire length, using the probe as a guide. The distal portion of the common duct, just at its entrance into the duodenum, was found to be extremely constricted, the lumen being filled with soft, shaggy tissue, through which the probe had been forced. Somewhat less than 1 centimetre above the orifice, however, the duct became enormously dilated, measuring, when opened and spread out, 7 to 8 centimetres across. The lining of this portion appeared smooth and shiny; there were no stones. A marked degree of dilatation was found throughout the hepatic duct as well, and extending into its larger branches, it being possible through several of these to pass the little finger well into the substance of the liver. No trace of the entrance of the cystic duct could be discovered.

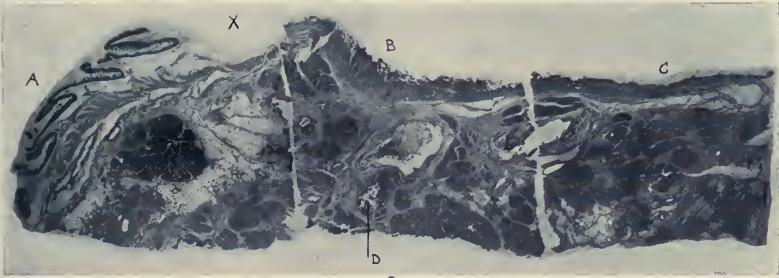
The pancreas felt very hard and nodular, and the gross diagnosis of carcinoma of that organ, with pressure on the common duct, was made. No dilatation of the duct of Wirsung could be made out macroscopically, nor were any cysts to be seen.

Microscopic Examination.—Sections made from various parts of the pancreas reveal the presence of a moderately high-grade chronic pancreatitis, with some subacute inflammation as well, the pancreatic acini being separated by broad bands of connective tissue, which shows in certain areas a fairly intense round-cell infiltration. The excretory duct and its branches show some dilatation, though this does not anywhere become very pronounced. Very many of the acini likewise show a slight cystic condition, not presenting the usual appearance of practically solid groups of cells, but containing a distinct lumen, around which the cells are arranged in a band of varying thickness (Fig. 3). This condition of the acini forms the most striking histologic feature of the pancreas—it exists throughout the entire organ, but is more marked in sections taken from near the head, the cystic acini decreasing markedly in numbers as the tail is approached. Nothing suggestive of malignancy is found in any of these slides, but a large section taken through the wall of the duodenum, passing directly through the papilla of Vater into the common duct and including a portion of the underlying pancreas, shows the presence of a small area of carcinoma situated exactly at the papilla, apparently arising from the duodenal mucosa. This is well shown in Fig. 1, a very low-power photograph. At *A* the duodenal mucosa is entirely normal, but as the region of the papilla is reached (a small portion of the mucosa at *X* became accidentally torn off during the preparation of the tissue) the mucosa becomes markedly thickened, and under higher power presents the typical appearance of a cylindrical-cell, glandular carcinoma. The histologic picture here is that of a rather dense connective-tissue stroma, everywhere riddled with atypical, irregular, gland-like formations, exceedingly variable in size and shape, lined by fairly tall, mucoid cells, arranged for the most part in a single layer, but presenting in places a distinct multi-layered formation (Fig. 2).

While by far the greater portion of the carcinomatous process is limited to the thickened intestinal wall, several scattered nests are found fairly deep in the portion of the pancreas immediately beneath this region. These present the same general characteristics as those already described, and are for the most part to be readily distinguished from the pancreatic tissue, though in places some difficulty is experienced in distinguishing some of the smaller cancer alveoli from slightly dilated and irregular pancreatic ducts, owing to the great similarity of the lining cells. Aside from this pancreatic involvement, no extension of the carcinomatous process beyond its point of origin is to be seen. The liver shows a moderately high grade of cirrhosis.

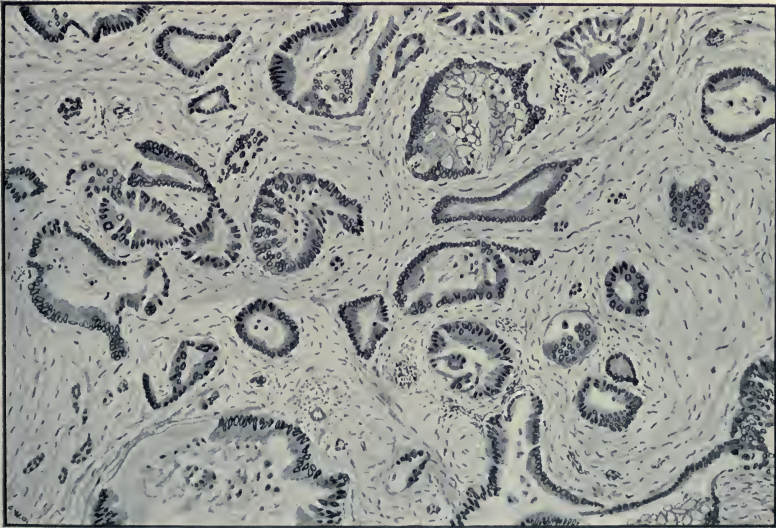
The exact point of origin of a primary carcinoma occurring in the region of the papilla of Vater is usually extremely

FIG. 1.



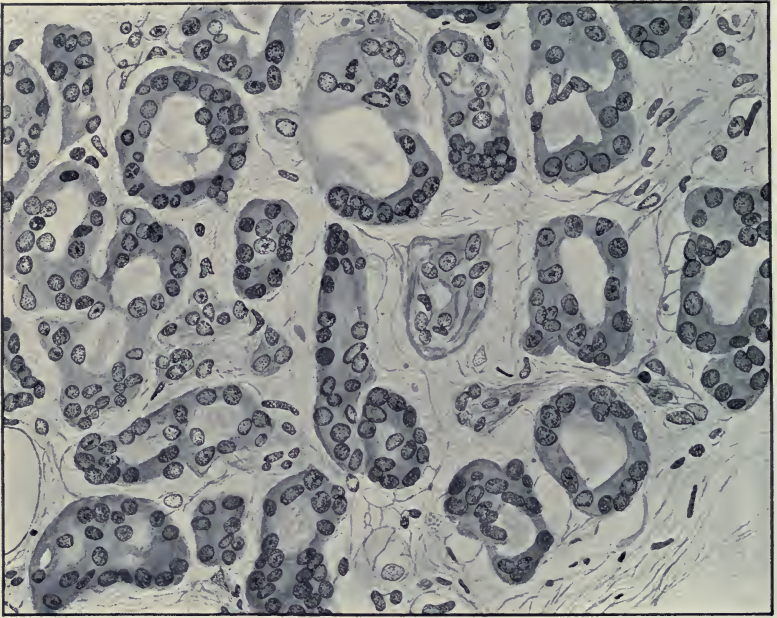
Section through the papilla of Vater. A, normal duodenal mucosa; B, carcinoma at site of papilla of Vater; C, common duct; D, carcinomatous area in the pancreas.

FIG. 2.



Carcinoma in duodenal wall.

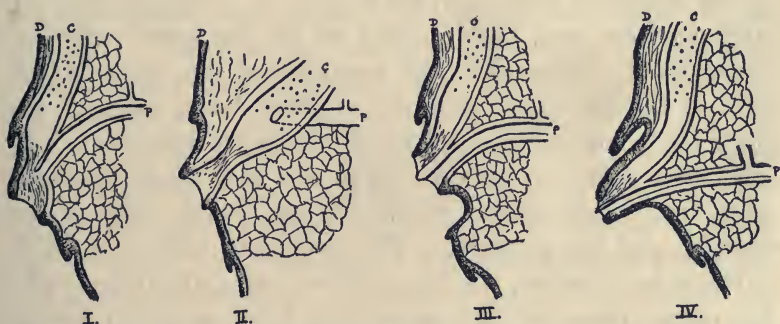
FIG. 3.



Section from pancreas, showing cystic acini.

difficult and in many instances impossible of determination. The structures involved are extremely small in size, complex in arrangement, and their anatomic relations are by no means constant. A true *ampulla*, in the sense of a small pouch or sacculation, lying within the papilla, and receiving on the one hand the pancreatic and common ducts, and emptying on the other hand into the duodenum (Fig. 4, Type I), is present, as has been shown by Letulle, in only about one-third to one-fourth of all individuals. More often one of three chief

FIG. 4.



Anatomic relations of the bile and pancreatic ducts at their duodenal end (after Letulle).
 D, duodenal mucosa; c, common duct; P, pancreatic duct (Wirsung).

variations is found: either the pancreatic duct merely empties into the choledochus at some distance from the duodenal wall, without the formation of a true ampulla (Type II); the two ducts open side by side on the surface of the intestine, without the formation even of a papilla (Type III); or the two ducts together form a prominent papilla in the duodenal lumen, but remain separate (Type IV). Finally, the ducts occasionally empty some distance apart, bearing therefore practically no relation to each other. By no means all primary epithelial tumors of the Vaterian region arise from the duodenum proper, but theoretically at least six points of possible origin must be considered: (1) the epithelial cells lining the true ampulla, when this is present; (2) the cells lining the common duct at its lower end; (3) the cells lining the pancreatic duct at its lower end; (4) the duodenal mucosa immediately cover-

ing the papilla; (5) the glands of Brunner, situated beneath the duodenal mucosa; (6) aberrant pancreatic acini in the wall of the common duct. As will be seen by reference to Appendices A and B, tumors have actually been described as arising from each of these structures. Owing to the intimate relationships between these, however, and to the great similarity in form of the lining cells of many of them, even an exceedingly small growth may have so extended beyond its immediate point of origin that this can at best be conjectural.

In the specimen under consideration, the gradual passage of the duodenal mucosa from a normal condition into the carcinomatous area, the fact that by far the greater portion of the latter is situated in the mucosa, and the characteristic form of the carcinoma acini and of their lining cells, all indicate the origin to have been in all probability intestinal. The only other points of origin that in this case could seriously come into consideration would be the lining cells of the ampulla, and the pancreas. The latter can with reasonable certainty be excluded, for the scattered areas of carcinoma in that organ, many of them apparently lying in lymph spaces, present all the characteristics of a secondary invasion, as contrasted with the much more compact and continuous involvement of the intestinal wall. The possibility of an origin from the cells of the ampulla must, however, be admitted, though owing to the characteristics stated above, and the much greater frequency of duodenal as compared with true ampullar carcinoma, the present case must be considered as falling within the former group.

Considerable labor has been spent by various investigators in attempting to discover some histologic characteristics by which it would be possible to differentiate with certainty ampullary, ductal, and duodenal carcinomata, but these efforts have as yet been without definite result. From the practical stand-point, however, such a differentiation is at best more or less a matter of hair-splitting, for the symptomatology and surgical indications of all these tumors of the Vaterian region are similar, and bear little relation to the precise group of

cells in which they have originated. It appears justifiable, therefore, to consider this group of tumors more or less as a unit, although from the strictly histogenetic stand-point some—probably the majority—should be classed as duodenal, some as biliary, and a few as pancreatic in origin.

Etiology.—In considering the etiology of malignant growths of the papilla of Vater, the question of the gall-stone factor assumes the foreground of interest. It has been repeatedly shown that gall-stones are or have at some time been present in a large majority of cases of primary carcinoma of the gall-bladder, and, possibly to a slightly less extent, of the gall-ducts. This does not, however, appear to be the case with regard to the group of tumors which we may class as “Vaterian carcinomata,” in these gall-stones appearing—from the reported cases at least—to play a comparatively minor rôle. Thus, Schüller, in 1901, found a history of gall-stones in but 15 per cent. of 41 cases of carcinoma of the papilla of Vater, and the writer, in an analysis of 110 cases from the literature, was able to find mention of stones in but 23, or about 20 per cent. Nevertheless, it must be considered highly probable that the passage of stones through the common duct must in a certain proportion of cases be an etiologic factor of great importance, especially since the papilla forms the most frequent point of incarceration, with attendant chronic irritation of the mucous surfaces. This would seem to be particularly true of the case here reported. The occurrence of a stone in the gall-bladder, the complete fibrous obliteration of the cystic duct, the very early occurrence of pain with the jaundice, the rather long intermissions between attacks at first, and especially the comparatively long interval—one and three-fourths years—elapsing between the onset of symptoms and death, all point to the probability of a primary condition of cholelithiasis with passage of stones, with secondary development of malignancy at the papilla.

Symptomatology.—The most complete analysis of the subject of malignant disease of the duodenum—including all tumors of the papilla of Vater, no matter what their histologic

origin—as yet made is that of Geiser, who in 1906 collected 51 cases of what he calls “periampullar” carcinoma. After a fairly extensive search through the literature, I have been able to collect 58 additional cases, giving, with the one reported in this paper, a total of 110 available for analysis. In Appendix A will be found a brief synopsis of all cases (20 in number, including five already reported by Geiser) which have been subjected to radical operation; in Appendix B is a similar synopsis of the cases in which either no operation, or merely a palliative one, has been performed. (For the sake of brevity, all cases without radical operation, already reported by Geiser, are omitted from Appendix B). This list makes no pretense at being absolutely exhaustive, as a number of cases have been reported in inaugural dissertations and other sources to which I have not had access.

In analyzing these 110 cases, we find that no single symptom is common to all, not even jaundice, which, however, is naturally by far the most frequent. In four cases it is distinctly stated that jaundice was not present; in two there was very slight discoloration of the sclera or skin, hardly sufficient to be classed as icterus, and in two no mention of the subject is made; in all other instances, however, jaundice, often of a most intense type, is specifically mentioned as a prominent feature of the clinical picture. In two of the cases (Durand-Fardell,¹¹ Devic and Savy) where icterus was not present, this fact is explained by more or less extensive ulceration of the central portion of the growth; in a third case (Lannois and Courmont) there was no constriction, but rather a dilatation, of the common duct at its point of passage through the tumor, due apparently to eccentric growth of the latter.

In the vast majority of cases jaundice was gradual in onset and progressive, though in quite a number the onset was sudden, and in a considerable proportion a distinct intermittency was noted. In most of the cases in which the jaundice was intermittent, it was so only in amount, never entirely disappearing after having once become manifest, though in a few instances there was complete clearing up between attacks. This intermittency was by no means associated only with those

cases in which stones were present; indeed, one author (Rendu) thinks intermittence in jaundice is due to variations in the turgescence and vascularization of a neoplasm, and considers it characteristic for tumor of the papilla as opposed to pancreatic carcinoma, in which the jaundice is more apt to be steadily progressive, a conclusion that can hardly be considered altogether correct, however, in view of the much larger number of cases of tumor of the papilla showing progressive than intermittent jaundice. Associated with jaundice in a large number of the patients were pruritus, rapid loss of weight, anorexia, and in practically all more or less marked discoloration of the stools, amounting in many instances to complete acholia.

Next to jaundice and its associated conditions, the most frequent symptom noted was pain. This feature is not included in Geiser's tabulation, but in the fifty-nine cases collected by the writer it was present twenty-seven times, or in nearly one-half. It is described as affecting chiefly the gall-bladder and liver region in six cases, the epigastrium in nine, the abdomen in eight, the back in two, not localized in two. In cases where the pain was distinctly colicky in nature, stones were usually, but not always, present. The occurrence of colics with tumor obstruction, in the absence of stone, is explained by Stein, who reports such a case, on the theory that as the result of bile stasis, with consequent distention of the gall-bladder and ducts, sufficient irritation of the nerve endings in the mucosa is produced to set up pathologic contractions of those organs, in an attempt to empty their contents.

Of less frequently occurring symptoms, vomiting is mentioned 12 times in the entire series of 110 cases, fever likewise 12 times, intestinal hemorrhage twice, ascites 3 times. In many instances, however, the reports of cases are so meagre and incomplete that undoubtedly many symptoms were present of which no mention has been made.

Duration.—A most important feature of malignant disease of the papilla of Vater, from the clinical stand-point, is the rapidity with which it usually proceeds to a fatal termination. Of 47 cases, in which the time elapsing between the

onset of noticeable symptoms and death is given with sufficient accuracy to be available, the average duration was but $7\frac{1}{3}$ months; the longest time reported was 3 years, in Mayo Robson's case, and there were but 3 others over $1\frac{1}{2}$ years. In one of these (Herrick, $2\frac{1}{4}$ years), the histologic diagnosis of the tumor was not carcinoma but "adenofibroma"; in the second (Morian, $1\frac{3}{4}$ years), obstruction was relieved comparatively early by a cholecystenterostomy; and in the third (the author's, $1\frac{3}{4}$ years), it seems probable that the earlier symptoms may have been due to gall-stones, rather than to the tumor. The extreme rapidity with which tumor of the papilla can produce death is shown further by the fact that of these 47 cases, in 23—practically 50 per cent.—the duration was 6 months or less, and in 10 it was under 3 months.

A second feature of great clinical importance is that in the majority of cases death ensues before metastasis or extension of the malignant process has occurred; in other words, while the condition is still, potentially at least, *surgical*. The views of different authors upon this subject are extraordinarily at variance, probably dependent upon each man's individual experience with a very small number of cases. Thus, Oehler says that tumors of the papilla possess marked tendency to metastasize, especially the adenocarcinoma types; Schüller, on the other hand, thinks that this rarely occurs, owing to rapid death of the patient; Geiser believes that the tendency to form metastases is very great, while Letulle and Kausch consider it slight. Examining the 110 reported cases from this stand-point, we find the occurrence of metastases noted 25 times, or in about 22 per cent.; in a few additional instances a limited amount of direct extension to the connective tissue lying between the duodenum and the pancreas, or to the pancreas itself, was present. In over three-fourths of the cases, however, the growth was limited to the papilla and its immediate surroundings, death occurring apparently as a result chiefly of interference with the flow of bile, and not as a result of malignancy *per se*.

A feature common to nearly all these tumors is their small size. Oesterreich mentions a growth at the papilla the size

of a small apple, Stein one of 5 cm. diameter, Lannois and Courmont one the size of a 5-franc piece, Martha one as large as the fist, but aside from these, and a very few others, practically all the tumors recorded are small, being compared by their reporters to a pea, bean, cherry, small nut, etc. In other words, it is evident that in the large majority of cases, a malignant growth at the papilla of Vater leads to the death of the individual before it has had time to reach any considerable size, or to become disseminated throughout the body. If subjected, therefore, to prompt and radical surgical attack, the condition should in a fair percentage of cases be curable, notwithstanding the great technical difficulties to be overcome.

Diagnosis.—The positive diagnosis of carcinoma at the papilla is a matter of great difficulty, and has comparatively seldom been made before operation or autopsy. There is, as has been shown, no pathognomonic or even any constantly recurring symptom associated with it. The conditions with which it is most likely to be confused are obstruction of the common duct by stone, benign stenosis from scar formation, chronic interstitial pancreatitis, and cancer of the head of the pancreas.

Where a definite swelling can be palpated in the gall-bladder region, associated with jaundice, rapid wasting, acholic stools, etc., presumptive evidence is furnished against stone and in favor of malignant disease, either at the papilla, or in the common or hepatic duct, as was originally pointed out by Courvoisier. It is impossible to say, however, in how many of the cases of tumor of the papilla this diagnostic aid was to be elicited; in comparatively few of the reports is any mention made of the presence of a palpable mass in this region during life. In almost every instance, however, very decided dilatation of the gall-bladder and common duct was found upon opening the abdomen at operation or autopsy, most of the few exceptions being cases in which there was perforation of the gall-bladder, with resulting collapse. In the majority of cases the degree of dilatation attained by the common duct is most striking, as in the author's specimen, where the duct measured, opened out, 8 centimetres across; a few cases of

even somewhat greater enlargement are on record. One would hardly believe that such extreme degrees of dilatation of this canal could take place in the short space of time elapsing, in many instances, between the onset of symptoms and death, but yet, while unquestionably the onset of symptoms may by no means be coincident with the beginning of the tumor formation, it does not seem probable that the common duct would undergo much dilatation until the tumor had reached a size sufficient to cause constriction of the lumen and produce marked damming back of the bile, at which time jaundice would begin to make its appearance. It seems probable, therefore, that the common duct is capable of undergoing rather rapid dilatation to many times its normal size.

An interesting and somewhat anomalous condition, which has been observed by a number of writers, is that of a much dilated gall-bladder and common duct, both filled with perfectly clear fluid, with *patulous cystic and hepatic ducts*, and obstruction at the papilla of Vater. A case of this kind has been carefully studied by Kausch.²⁶ At operation upon a patient with steadily increasing jaundice, the gall-bladder and common duct were found enormously distended with clear fluid; a cholecystostomy was performed, and for two hours clear fluid flowed from the tube. Then the discharge began to be slightly colored, and by the end of six hours it had assumed the appearance of somewhat pale bile, large quantities of which continued to flow as long as the sinus was left open. At autopsy, some weeks later, a small tumor was found at the papilla of Vater. Kausch thinks that the hydrops in these cases is due to excessive secretion by the mucosa of the gall-bladder and ducts, whereby, the duodenal opening being occluded, the pressure in the biliary system is so raised that the bile secreted by the liver cells is poured, not into the excretory ducts but back into the blood and lymph vessels of the liver. It is evident that the liver cells have not ceased to functionate, for had such been the case the jaundice would have disappeared, and the flow from the gall-bladder would not have become bile colored within a couple of hours after the pressure was relieved. Similar cases have been reported

by Lenormant, who agrees entirely with Kausch as to the mechanism of their production, by Arnsperger, Carnot and Harvier, Dominici, Halsted, Hanot,²⁰ Martha, Oppenheimer, Riedel, and Berg; in the last named the obstruction was due not to a tumor but to a stone, associated with infection of the biliary passages. The occasional occurrence of such cases is of importance from the operative stand-point, as they show that the mere fact of finding a gall-bladder filled with clear fluid is no proof of the occlusion of the cystic duct.

Pancreatic Changes.—The most frequent changes observed in the pancreas as a result of occlusion at the papilla of Vater—aside from the occasional direct extension of the tumor into the pancreatic tissue—are dilatation of the ducts, atrophy of the acini, and overgrowth of connective tissue. Dilatation of the ducts is, as a rule, moderate in amount, often only to be detected microscopically, and practically never reaching a degree comparable to that of the common bile-duct. Weir speaks of a cystic cavity the size of an egg in the head of the pancreas, representing a dilated duct, but this is decidedly an exception. I have not found in any of the reports mention of a widely disseminated microcystic condition of the pancreatic acini, such as was present in the case reported at the beginning of this paper (Fig. 3), though it would seem that such a condition would be a frequent result of partial obstruction of the main excretory duct.

It is remarkable that with the high degree of pancreatic atrophy and fibrosis frequently reported, in only one case—that of Schüller—was glycosuria mentioned as a prominent feature, and even in this instance it did not persist throughout the entire course of the disease. Rolleston, among others, calls especial attention to this fact. In his case many of the pancreatic ducts were dilated and contained calculi, and there was very advanced fibrosis, but no glycosuria. While undoubtedly in many of the reported cases no test for sugar was made, in by far the larger majority it is distinctly stated that this examination was carried out, and was found negative.

Treatment.—The only rational treatment for carcinoma of the papilla of Vater is radical extirpation, if this can be car-

ried out. It has been attempted, as has been said, in about 20 reported cases (Appendix A), with, it must be admitted, not very brilliant results so far. In these 20 cases, there were 8 primary deaths, and 12 patients recovered from the immediate effects of the operation. Of the latter, 5 are reported as subsequently dying, in 2 cases no data are given beyond the fact that primary recovery took place, and of the remaining 5, two are reported as well 7 months after operation, one 10 months, one 2 years, and one $3\frac{3}{4}$ years. As in all forms of carcinoma, early diagnosis is the *sine qua non*, but this is especially true in the type under consideration, owing to the rapidity with which a fatal termination may ensue. On the other hand, however, there is perhaps scarcely any form of malignant disease which so early sends out warning signals as that producing obstruction to the bile-ducts, signals that as a rule make themselves manifest while yet the growth is small, localized, and comparatively accessible.

In 14 of the reported 20 radical operations, the duodenum was opened by a longitudinal or transverse incision, and the growth, with a small amount of surrounding healthy tissue, excised, the bile- and pancreatic ducts being cut through, and then reimplanted into the duodenal wall. In one case the duodenum was opened, the growth simply curetted away, and the site cauterized, while in the remaining five cases resection of a portion of the duodenum was performed. Several authors advocate a two-stage operation, believing that the obstructive symptoms (cholæmia, etc.) should be relieved by a less serious procedure than radical extirpation of the tumor, which the patients are rarely in a condition to stand satisfactorily; this to be followed subsequently by the radical operation. Procedures of this sort have been reported by Mayo and Kausch; in the former's case the first operation was a cholecystostomy, in the latter's, cholecystenterostomy; in both instances primary recovery took place. For the first operation, Kausch does not favor simple cholecystostomy with drainage, for while this relieves the cholæmia, it causes too great a loss of important body fluids; he considers, therefore, a cholecystenterostomy the operation of choice for the first sitting, believing that this,

by conducting the bile and in some instances the pancreatic juice as well back into the intestine, places the patient in better condition to withstand the more serious operation later on.

Conclusions.—1. Carcinoma of the papilla of Vater, while by no means a frequently occurring condition, has been reported often enough to be of considerable clinical importance.

2. It may arise from one of several groups of cells, the exact point of origin having, however, little effect on the symptomatology, clinical course, or surgical indications.

3. The duration of the disease is comparatively short, the average time elapsing between the onset of symptoms and death being about seven months, and in many cases less than three months.

4. In most cases death results from cholæmia before metastasis or invasion of surrounding organs by the tumor has occurred.

5. Radical extirpation is technically possible, and if undertaken early enough should lead to a fair percentage of cures.

NOTE.—Since the completion of the above, two additional cases of radical operation have been reported, one by Upcott (*ANN. SURG.*, Nov., 1912), and the other by Slajner (*Zntbl. f. Chir.*, 1912, xxxix, 259; also reviewed at some length in a recent article by Kausch; *Beitr. f. klin. Chir.*, 1912, lxxviii, 439). Upcott's case was a male, aged sixty-five years. The oval tumor, about the size of an olive, was removed through a transverse incision in the anterior duodenal wall, the edges of the common duct being then sutured to the duodenal mucosa. The patient recovered, but too short a time has elapsed to say anything of the ultimate result. Microscopically the tumor proved to be a columnar-cell adenocarcinoma.

Slajner's case was a male, aged forty-eight years. The small tumor was removed through a longitudinal incision in the anterior duodenal wall. The common and pancreatic ducts were then sutured to the duodenal mucosa. The patient died 36 hours later in collapse, with cholæmic hemorrhage. Microscopically the growth showed adenocarcinoma, arising from glands at the mouth of the papilla.

APPENDIX A.

Cases of Carcinoma at the Papilla of Vater which have been Subjected to Radical Operation.

The following abbreviations are used throughout Appendices A and B: **G.bl.**—Gall-bladder; **Com.d.**—Common bile-duct; **Pan.d.**—Pancreatic duct (Wirsung); **Pap.V.**—Papilla of Vater; **Dur.**—Duration of disease, from onset of first symptoms to death (or operation); **Op.**—Operation; †—Death.

ARNSPERGER:¹ Case 28: F., 43. Increasing jaundice for 6 weeks; g.bl. palpable. Op. (Voelcker). G.bl. distended; one stone size of a hen's egg. Nodule size of a walnut palpable in duod. at pap.V. Transverse incision of duod., tumor dissected out from surrounding tissue; 4 cm. of com.d. resected. Cut ends of com. and pan.d. implanted in duod. wall; duod. incision closed. † 2d day from hemorrhage (probably from pancreatic wound).

CORDUA:⁷ F., 41. Jaundice; g.bl. palpable. Op. Carcinoma size of a 10-Pfg. piece found at pap.V. and excised. Com.d. sutured to post. wall of duod.; duodenal incision closed. Cholecystectomy. Gastro-enterostomy. Patient recovered, and gained in weight.

HALSTED:¹⁸ Case 2: F., 60. Jaundice; pruritus. Op. G.bl. and ducts greatly dilated; contained sand and clear fluid. Hard body felt at pap.V. A portion of the duod., with $\frac{3}{4}$ inch. of the com.d., and a shorter piece of the pan.d., resected; end-to-end anastomosis. Com. and pan.d. implanted into duod. along line of suture. Recovery; 3 mos. later 2d op. Anastomosis between duod. and g.bl. † Few mos. later. Autopsy: carcinoma had recurred in duod. and head of pancreas.

HARTMANN:²² Case 1: M., 60. Progressive jaundice; one slight remission. Op. (Navarro). G.bl. found dilated; com.d. size of thumb. Induration felt at pap.V. G.bl. aspirated; duod. opened. Tumor size of a pea found at pap.V. Circular incision around this, cutting com.d. 2 cm. and pan.d. 1 cm. above tumor. The two ducts then sutured together, and into intestinal wall. Patient recovered; well and strong two years later. Micr.: carcinoma, arising from ampulla.

Case 2: Jaundice for 3 weeks; g.bl. palpable. Op. (Cunéo). G.bl. and ducts found dilated. Circumscribed nodule felt at pap.V. Duod. accidentally torn; opening enlarged, and a firm mass size of an almond seen in Vaterian region, projecting into duod. lumen. Lozenge-shaped incision around this, removing it, and cutting through pancreatic tissue. Com.d. sutured into upper portion of duod. incision; lower portion closed; middle portion left open, and cut surface of pancreas brought into it. Posterior gastro-enterostomy. † 5th day. Micr.: carcinoma, arising from terminal portion of com.d.

HOTZ²⁴ (also OPPENHEIMER⁴⁶): F., 61. Progressive jaundice for 7 months; pruritus; pains in gastric region. Op. (Hotz). G.bl. and ducts found distended. Tumor 5 cm. in length felt at opening of com.d. into duod. Post. gastro-enterostomy; then longitudinal incision in ant. duod. wall. Papilla found enlarged to a mass size of thumb; this was pulled

forward, and incised around the base; com. and pan.d. dissected free for about 4 cm., then cut across. Cut edges of these sutured to duod. mucosa; incision in duod. closed. Patient well and able to work 7 mos. later. Micr.: adenocarcinoma, arising from lower end of com.d.

KAUSCH:²⁵ M., 49. Jaundice for 6 weeks. Op. G.bl. size of fist; nodule size of a pea palpable at pap.V. Cholecystenterostomy and entero-anastomosis. Jaundice disappeared. Two mos. later 2d op. Gastroenterostomy; closure of pylorus. Duod. then shelled out from above downward; piece of the pancreas size of a walnut resected, cutting through pan.d. in substance of pancreas. Duod. cut through at junction of pars inferior and descendens; cut end of remaining duod. drawn like a cap over cut surface of pancreas, and held by catgut sutures, the com.d. also being brought into duod. lumen. Recovery; † 9 mos. later from cholangitis.

KÖRTE:²⁸ F., 44. Jaundice; colicky pains. Op. G.bl. and com.d. both found enlarged; no stone. Duod. incised; tumor size of a small cherry found blocking exit of com. and pan.d. Tumor and surrounding mucosa excised; com. and pan.d. sutured to duod. wall. † 8th day. Micr.: adenocarcinoma.

KÖRTE:²⁹ F., 52. Jaundice, pains, fever, malaise for 14 weeks. Op. G.bl. and ducts much enlarged; contained pus. Induration and stenosis felt at opening of com.d. into duod., but no tumor. Duod. incised; the stenosed com.d. opening slit up; com. and pan.d. drained. Patient well for 1½ yrs., then jaundice returned. 2d op. Hard nodule size of a bean felt at mouth of com.d. Circular resection of duod., with end-to-end anastomosis. Com. and pan.d. cut through, sutured together, and then into post. duod. wall. † 3d day. Micr.: adenocarcinoma.

KÖRTE:³⁰ Case 32: F., 47. Jaundice for several months; pruritus; palpable tumor in liver region. Came to hospital on account of fracture of tibia. Op. G.bl. and ducts found much dilated; contained thick sand, but no stone. Longitudinal incision of duod.; hard tumor size of little finger at pap.V. Tumor excised; com.d. sutured to duod. mucosa. Patient well 3¾ yrs. later. Micr.: carcinoma of terminal portion of the com.d.

MAYO:³² F., 59. For many years sudden attacks of pain in epigastric region, lasting several hours, and ending with vomiting; sometimes jaundiced during these attacks. For 1 yr. loss of weight and appetite; moderate jaundice. Op. G.bl. enlarged; contained one stone size of a pea. Com. and cystic ducts moderately dilated. Cholecystostomy; jaundice disappeared, but stools remained acholic. Three mos. later 2d op. Hard mass size of a filbert felt through duod. wall at end of com.d. Incision in ant. duod. wall, exposing a grayish-white mass limited to pap.V. Excised; raw surface cauterized. Duod. closed. Recovery. Micr.: cylindrical-cell carcinoma.

In a subsequent paper, the Mayos⁴⁰ state that they "have had several examples of primary carcinoma at the pap.V., with two primarily successful excisions, but no case has lived beyond 3 years."

MAYO-ROBSON:⁴¹ Case 536: M., 30. Three years previous, abdominal pain and jaundice for 4 weeks; 3 mos. later pain again, but no jaundice. Since then several attacks of pain, without jaundice. Op. A growth,

which had evidently started in region of pap.V., found involving inner portion of duod., whence it had extended to pylorus and head of pancreas. In separating adhesions a perforation of duod. discovered which could not well be closed; portion of duod. and pylorus resected; duod. and stomach united by sutures. As it was clear that the com.d. would be obstructed, g.bl. drained, with view to subsequent cholecystenterostomy. † Few days later.

MORIAN: ⁴⁶ Case 4: Sudden onset of jaundice; pruritus. Op. G.bl. found distended; com.d. size of thumb. Tumor size of hazel-nut felt at pap.V. Cholecystenterostomy; then longitudinal incision in ant. duod. wall. Circular incision around tumor; com. and pan.d. cut through; tumor mass removed; both ducts sutured into duod. wall. Incision in duod. closed. Recovery; 10 mos. later patient apparently well, had gained over 20 lbs., and was able to do ordinary housework. Micr.: carcinoma.

OEHLER: ⁴⁶ F., 60. Pains in gastric region; jaundice; pruritus. G.bl. palpable as pear-shaped mass. Dur. 5 mos. Op. (Kraske). G.bl. incised and emptied. Com.d. found distended; incised. No stone, but obstruction felt at pap.V. Transverse incision in ant. duod. wall; a hard, papillary tumor, slightly ulcerated, size of a hazel-nut, found completely surrounding opening of com.d. Tumor excised, keeping well in healthy tissue; bed cauterized. Com.d. and duod. sutured together; duod. and com.d. incisions closed. No metastases found. Recovery. Micr.: adenocarcinoma, arising from duod. mucosa.

OPPENHEIMER: ⁴⁶ F., 63. Jaundice and gastric pain for 3 mos. Op. (Enderlin). G.bl. and cystic duct distended with clear fluid. Hard nodule size of a hazel-nut felt in region of head of pancreas, and a gland size of a cherry, at junction of cystic and hepatic ducts. Com.d. incised; stenosis found at pap.V. and cut through. A circumscribed tumor found adherent to duod. wall and pancreas. Whole of com.d. and surrounding indurated area resected; hepatic duct sutured to duod.; cholecystectomy. Stump of pan.d., which had also been cut through, sunk in duod. wall. Micr.: adenoma, arising from gall-ducts. Recovery; in 1 mo. patient had gained 15 lbs. † 1 yr. later from recurrence in liver.

RIEDEL: ⁵⁸ F., 50. For 9 months sharp attacks of pain in upper abdomen; for 6 months progressive jaundice. Op. G.bl. and ducts found much dilated, and filled with clear fluid. A yellowish-white tumor, size of a hazel-nut, at pap.V. Com. and pan.d. cut through; duod. resected, and the two ducts sutured into duod. wall. † Same day from shock (advanced pulm. tbc.).

RIXFORD: ⁴⁴ F., 33. Jaundice for 4 months; sudden onset. Op. Mass felt in region of papilla; duod. opened by longitudinal incision, and a portion of the mass removed. Field of operation immediately flooded with bile. Duod. incision closed; g.bl. drained. Micr.: adenocarcinoma. One month later 2d op. Remainder of the little tumor excised, with adjacent portion of duod., 1½ inch of com.d., and 2 enlarged retro-peritoneal lymph-nodes. Patient well for 8 months, then jaundice recurred. 3d op. Cholecystenterostomy. † 4 mos. later.

SCHÜLLER ⁵⁶ (also ARNSPERGER,¹ Case 27): Case 1: M., 66. Progressive jaundice* for 6 months; chills; fever; glycosuria, which, however, only

lasted 4 weeks. Op. (Czerny). Icteric ascites. G.bl. contained 150 c.c. mucopurulent fluid; aspirated. A hard body size of a date-seed felt at pap.V. Longitudinal incision in ant. duod. wall; the little tumor, which appeared ulcerated, seized with forceps and drawn forward. Circular incision around it removing it in 3 pieces. Cut end of com.d. sutured to edge of duod. mucosa; tube placed in g.bl.; duod. incision closed. † 5th day from sepsis. Micr.: adenocarcinoma, arising from com.d., duod., or pancreas (?). Metastases in liver.

STEIN:²¹ F., 37. Attacks of pain in gastric region; vomiting; jaundice, with free intervals. Palpable, tender tumor in g.bl. region. Op. G.bl. much dilated; com.d. size of small intestine. Duod. opened; an area of 5 sq. cm. on post. wall found covered by a soft, friable, papillary tumor mass, surrounding pap.V. This curetted away, and site cauterized. Duod. closed. Patient recovered, and was well 7 mos. later. Growth considered a benign adenomatous proliferation of mucosa.

VERHOOGEN:²² F., 33. Sudden onset of jaundice; pain in right hypochondrium; vomiting. Dur. 8 months. Op. G.bl. size of a pear; no stones. Incision in ant. duod. wall. Little soft, fungoid tumor found covering pap.V.; resected; com.d. sutured to duod. mucosa. † 10th day. Micr.: glandular elements without atypical formation, "hence adenoma."

APPENDIX B.

Cases of Carcinoma at the Papilla of Vater without Radical Operation.

ARNSPARGER:²³ Case 30: M., 56. For 1¼ yrs. jaundice in varying degree. G.bl. enlarged; many small stones. Com.d. dilated; head of pancreas hard, size of an egg. Cholecystenterostomy. † 12th day. Autopsy: stenosis at pap.V. Micr.: scirrhus carcinoma of pap.V.

AVEZOU:²⁴ M., 72. Intense jaundice, with slight remissions; pruritus; constipation. G.bl. size of child's fist; com.d. size of index-finger. A circular, fungoid plaque, with raised edges, size of a 2-sou piece, found in duod. at level of pap.V., not, however, completely occluding orifice of com.d. Pancreas hard; no carcinoma. Dur. 8 mos.

CADE and LERICHE:²⁵ M., 46. Intense jaundice; occult blood in stools. Cholecystogastrostomy; 11 days later gastro-enterostomy; 5 weeks later exploratory op.; † 4th day after. G.bl. much dilated; com.d. size index-finger. Hard nodule size of a walnut on pancreatic edge of duod. at level of pap.V. Pancreas hard, prob. neoplastic. Dur. 6 mos.

CARNOT and HARVIER:²⁶ Severe, progressive jaundice; pain in epigastric region. Watery fluid in g.bl. Projecting from pap.V. a tuft of long, delicate villousities, attached to a neoplasm developed in lower end of pan.d. Micr.: carcinoma, originating from epith. cells of pan.d., presenting toward the lumen a villous, deeper an adenocarcinomatous structure.

COATS and FINLAYSON:²⁷ M., 48. Intense jaundice; sudden, severe pain in region of g.bl. 1 wk. before death. G.bl. greatly distended and perforated; com.d. 1¼ inches in diam. At terminal portion of com.d. a soft, prominent mass, partly ulcerated. Micr.: carcinoma, arising from com.d.; duod. mucosa not affected. Dur. 10 mos.

DEVIC and SAVY:⁹ M., 52. No jaundice. Umbilical pain after eating; vomiting. Gastro-enterostomy; † 36 hrs. later. G.bl. not distended; several stones. Com.d. size of a lead pencil. Annular tumor in duod., beginning 4 cm. from pylorus, and extending for 14 cm. Oldest portion apparently corresponds to site of pap.V. Micr.: encephaloid cancer, with superficial ulceration arising from intestinal mucosa. Pancreas normal, but surrounded by a mass of neoplastic glands. Dur. 4 mos.

DOMINICI:¹⁰ M., 70. Progressive jaundice; hiccough; tenderness in g.bl. region. G.bl. and all ducts distended; filled with clear mucoid fluid. A cone-shaped mass, 1 cm. in diam. at the base, and 1.5 cm. high, found projecting from pap.V. Micr.: cylindrical-cell carcinoma, arising from ampulla, com.d., and pan.d. Pancreas: dilatation of many ramifications of the ducts; irregularly disseminated atrophy of the acini; interstitial sclerosis. Dur. 6 mos.

DURAND-FARDEL:¹² M., 58. Sudden onset of jaundice, then progressive. G.bl. enormously dilated; walls thick. Com.d. forms a pouch 2 cm. in diam. where it joins the duod.; size of little finger above this. A round, hard, whitish mass, size of a cherry-stone, found projecting into com.d. exactly at the point where this enters the intestinal wall. Micr.: cylindrical-cell carcinoma, arising from the surface epithelium of the "canal ampullaire." Dur. 6 mos. (This case is considered by Bard a cancer of the pancreas, by Rendu an intestinal cancer, by Hanot a cancer "pancréatico-biliaire," and by Durand-Fardel himself a primary cancer of the bile-ducts.)

EDES:¹⁴ F., 48. Sudden onset of jaundice. G.bl. enlarged; many whitish stones. Com.d. enormously dilated to within 2 inches of duod., where an abrupt narrowing takes place; a small lymph-node found pressing on wall of com.d. at this point. No definite mass discernible macroscopically at pap.V. Micr.: carcinoma of pap.V. at orifice of com.d.; lymph-gland secondarily involved. Dur. 16 mos.

ELOESSER:¹⁵ M., 56. Intermittent jaundice. G.bl. moderately enlarged; walls thin; few mulberry stones. Cholecystenterostomy; † 13th day in collapse. Com.d. dilated. An indurated mass projects into duod. at orifice of com.d. Micr.: carcinoma, arising either from duod. mucosa, lower portion of com.d., or an accessory pancreas. (The author considers aberrant pancreatic acini in the wall of the com.d. the most probable source of origin, but does not bring forward any very convincing reasons for this belief.)

ELY:¹⁶ M., 53. Progressive jaundice; fever; pain and tenderness over liver. G.bl. and com.d. greatly distended; filled with whitish, puriform fluid. Cholecystostomy; † 10th day from hemorrhage. A little nodular tumor, 11 × 9 mm., at mouth of com.d., completely surrounding it, and narrowing the lumen. Micr.: cylindrical-cell carcinoma, arising from com.d. Pancreas: interstitial pancreatitis. Dur. 4 mos.

HALL:¹⁸ M., 46. Intense jaundice; fever. G.bl. dilated; thin, pale bile. Com.d. size of little finger. At pap.V., beneath duod. mucosa, a mass size and shape of a small bean, surrounding entire lumen of com.d., but not invading the deeper structures. Dur. 5 mos.

HANOT:²⁰ M., 40. Progressive jaundice, with slight remissions;

fever; sweats; pruritus; diarrhoea. G.bl. slightly dilated, and filled with clear fluid; com. and pan.d. dilated. At level of pap.V. a mass, size of a chestnut, projecting into intestinal lumen, surrounding opening of com.d. Micr.: cylindrical-cell carcinoma, prob. arising from intestinal mucosa. Dur. 18 mos.

HANOT:²¹ F., 58. Rapidly increasing, finally bronzed jaundice; pain in back; pruritus. G.bl. not dilated; com.d. enlarged to diam. of 5 cm. in lower portion, about normal in upper. A mass, the form and size of a cherry, exactly at pap.V., projecting into intestinal lumen. Micr.: cylindrical-cell carcinoma, arising from wall of ampulla only; intestinal mucosa normal. Dur. 10 mos.

HARTMANN:²² Case 3: M., 61. Jaundice, pains, fever, sweats; all intermittent. One stone in com.d.; removed. † 8th day (pulm. tbc.). A mass size of an almond at pap.V., extending 2.5 cm. into com.d. Micr.: villous carcinoma, infiltrating duod. wall; origin, com.d. Dur. 1 yr.

HERRICK:²³ M., 66. Sudden onset of jaundice, then progressive; soreness at right costal margin. G.bl. and all ducts greatly dilated. A mass of dense white tissue, about 2.5 cm. in diam., localized at pap.V., occluding all the entering ducts. Micr.: adenofibroma. Dur. 2¼ yrs.

KAUSCH:²⁴ M., 74. Progressive jaundice; pruritus; ascites. G.bl. size of fist and lower third of forearm; filled with clear fluid, likewise the com.d. Cholecystostomy; 5 weeks later cholecystenterostomy; † 3 weeks later. At pap.V. a tumor size of a small cherry, almost pedunculated, hanging free in intestinal lumen; pedicle formed from drawn-out intestinal wall.

KLOTZ:²⁵ Case 1: M., 62. Deep jaundice; constipation; nausea; vomiting; pain over liver. Com.d. size of thumb. The bile papilla projects as a firm, even mass into the duodenal lumen. Micr.: columnar-cell carcinoma of pap.V. Pancreas atrophic, with dilatation of pan.d. Dur. 6 mos.

Case 2: M., 40. Progressive jaundice; nausea; vomiting; pain in abdomen and back. G.bl. partially distended with dark, fluid bile. Com.d. distended and tortuous; constricted at several places by infiltrated glands. Site of the bile papilla the seat of a shaggy, necrotic ulcer, 3 × 2 cm., through which com.d. passes. Micr.: adenocarcinoma, arising from glands of Brunner. Pancreas indurated; a few of the outermost lobules invaded by the tumor. Dur. 8 mos.

LE BLANC:²⁶ F., 71. Progressive jaundice; fever. G.bl. much enlarged. Mass at entrance of com.d. into duod., involving head of pancreas and pap.V. Micr.: carcinoma. Dur. 8 weeks.

LENORMANT:²⁷ F., 68. Jaundice, at first intermittent, later progressive; pruritus; pain in right hypochondrium. G.bl. size of a small egg-plant; com.d. size of the thumb. Both filled with clear fluid. Cholecystectomy; † 1 week later from anuria. A small, well-defined tumor found at pap.V. Micr.: cylindrical-cell carcinoma, apparently arising from intestinal epithelium. Dur. 4 mos.

LETULLE and VERLIAC:²⁸ F., 68. Sudden onset of jaundice; diarrhoea; severe abdominal pain toward the end. G.bl. enormously distended with yellowish bile and gravel. Com.d. very narrow at terminal portion,

but passable for a fine probe; pan.d. completely obstructed. Tumor size of a pea found completely surrounding the pan.d. at its lower end, with slight extension to wall of com.d. Micr.: carcinoma, arising from terminal portion of pan.d. Pancreas indurated, atrophic; duct dilated throughout. Dur. 6 mos.

LINDNER:⁸⁰ Case 1: M., 50+. Intense jaundice; frequent colics. G.bl. enlarged; numerous stones. Small primary carcinoma in duod. portion of com.d. Dur. few weeks. Case 2: M., 60+. Symptoms and findings same as Case 1. Dur. several months. Case 3: M. Intermittent jaundice; pruritus. Cholecystenterostomy; † 5th day (cholæmic hemorrhage from stomach). Small carcinoma found at pap.V. Case 4: F., 56. Intermittent jaundice; colics. G.bl. moderately enlarged, com.d. much dilated; both filled with many large stones. Cholecystostomy; at 2d op. fistula closed; † 2 days later. Small primary carcinoma found in duod. portion of com.d.

MARTHA:⁸⁷ M., 60. Intense jaundice; severe abdominal pains; vomiting. G.bl. 19 cm. long; com.d. size of index-finger; both filled with clear fluid. Second portion of duod. transformed into a tumor size of the fist, most prominent at pap.V. Head of pancreas also cancerous. Origin probably pap.V., with secondary involvement of pancreas. Dur. 5 weeks. (Owing to the large size of this tumor, and lack of microscopic examination, its nature must be considered undetermined.)

MAY:⁸⁸ M., 67. Intense jaundice; abdominal pain last two days before death; pruritus. G.bl. perforated and collapsed; com.d. enormously dilated. Many small, blackish stones in g.bl., cystic and com. ducts. At mouth of com.d. a hard, ring-like tumor, size of a cherry, partly projecting into the duodenum. Micr.: cylindrical carcinoma, arising from duod. end of com.d. Metastatic nodules in liver. Dur. 1 yr.

MCNEAL (GEDDINGS):⁴⁸ Case 2: M. Universal jaundice, with slight remissions; vomiting; purging. G.bl. enormously distended; com.d. size of middle finger; stones in both. Mass in portion of duod. which is entered by com.d., completely occluding this; the mass shows "encephaloid degeneration," and is ulcerated toward the intestinal lumen. Trunk and primitive bifurcations of the portal vein completely occluded by encephaloid matter. Head of pancreas enlarged and hard.

MORAX:⁴⁴ F., 78. Progressive jaundice. G.bl. and com.d. dilated, and filled with thick, black bile. Hard nodule size of a bean in duod. wall at mouth of com.d. Micr.: cylindrical-cell carcinoma, arising from duod. mucosa. Dur. 3 weeks.

MORIAN:⁴⁸ Case 1: F., 63. Progressive jaundice. G.bl. markedly enlarged; many small stones. Com.d. dilated, and filled with a yellowish-white tumor mass, which extends up into hepatic duct. Micr.: carcinoma. White nodules in liver (metastases?). Dur. 4 mos. Case 2: M. 69. Jaundice; abdominal pains; ascites. Cholecystostomy. Six weeks later cholecystenterostomy; † 2d day. Autopsy: com.d. dilated; wall thickened for a distance of 1 cm., beginning just above pap.V. Dur. 5 mos. Case 3: F., 54. Jaundice, intermittent in intensity, pruritus. G.bl. shrunken; one stone. Com.d. size of thumb. Cholecystenterostomy.

At operation a tumor felt on post. wall of duod. at pap.V., resembling male nipple; head of pancreas also hard and nodular. Considered a neoplasm of pap.V., which had invaded pancreas. Recovery; † 1¼ yrs. later with signs of general metastasis. Dur. 1¾ years.

OESTERREICH:⁴⁷ M., 39. Intense jaundice. G.bl. and com.d. much dilated. Tumor at pap.V. size of a small apple. Micr.: cylindrical-cell carcinoma. A few metastases on surface of liver and in coeliac glands.

RENDU:⁵² M., 53. Intermittent jaundice; epigastric pain; fever; headache. G.bl. enlarged, filled with mucus; cystic duct obliterated. Com.d. 3 cm. in circumference; contains bile and pus. Exactly at position of pap.V. a plaque 3.5 × 2 cm., slightly elevated above the intestinal mucosa. Micr.: cylindrical-cell carcinoma, resembling those of intestinal origin; does not extend beyond submucosa. Small metastatic nodule in liver. Dur. 4½ mos.

ROLLESTON:⁵⁵ M., 66. Jaundice; pruritus. G.bl. and all ducts greatly dilated; com.d. size of thumb. Flat growth found limited to pap.V., occluding the orifices of the com. and pan.d. Micr.: columnar-cell carcinoma, invading the smooth muscle tissue around the pap.V. Pancreas: fibrosis; ducts dilated. Dur. 11 weeks.

SEARS:⁵⁷ M., 49. Progressive jaundice; pruritus; constipation. Patient had had an attack of catarrhal jaundice 18 years before. At operation g.bl. found distended, and full of viscid fluid; † 2 days later. Autopsy: tumor size of a pea found at pap.V., completely occluding it. Dur. few weeks.

SHEPHERD⁵⁸ (also DUVAL¹⁸): M., 44. Progressive jaundice; pruritus. G.bl. distended with thick, dark bile; com.d. three times normal size. Cholecystostomy; † 5 weeks later from exhaustion. In lower portion of com.d. a soft, brownish-black, fungoid mass, 2.5 cm. long, completely occluding the lumen of the com.d.; entirely confined to com.d. and ampulla. Micr.: composed almost entirely of pigmented cells, but structure resembles in many ways that of epithelioma. Origin, apparently tunica propria of com.d. and ampulla. Diagnosis: "melanoma." Dur. 3½ mos.

SOUQUES and AYNAUD:⁵⁹ Case 1: F., 43. Jaundice; cough; expectoration. G.bl. dilated; com.d. size of index-finger. A hard tumor, size of a pea, at pap.V. Com.d. passes through the tumor, but is not completely obstructed. Micr.: cylindrical-cell carcinoma, arising from ampullary portion of com.d. Metastatic nodules in liver and lungs. Dur. several weeks. Case 2: M., 72. Progressive jaundice; pruritus; abdominal colics; diarrhoea. All ducts dilated. At pap.V. a round tumor, somewhat smaller than in Case 1, pushing up duodenal mucosa. Micr.: cylindrical-cell carcinoma, infiltrating walls of com.d. and completely obstructing its lumen. Dur. 3 mos.

STABEL:⁶⁰ M., 50. Intense jaundice; chills; pain in liver region. G.bl. greatly distended. Cholecystostomy; † from abscess in kidneys and prostate. Primary carcinoma found in com.d. at its opening into duod.

STOKES:⁶² M., 68. Deep jaundice; fever; chills; pruritus; constipation. Distinct remissions in all these symptoms from time to time.

G.bl. and com.d. greatly distended; walls of former thickened. Orifice of com.d. in duod. surrounded by an irregular fungus, resembling an old cicatrix. Dur. $1\frac{1}{2}$ yrs.

THOMAS:⁸⁸ F., 53. Persistent jaundice. All ducts much dilated, and filled with puriform fluid. At pap.V. a tumor, ulcerated toward duod. Micr.: cylindrical-cell carcinoma, arising from the ampulla, or (according to Letulle) from the intestinal mucosa covering this. Dur. 4 mos.

WEIR:⁸⁹ M., 35. Very marked jaundice; pain in liver region. G.bl. and all ducts dilated. Cyst in pancreas drained; 10 days later cholecystenterostomy; † 2 hours later. A soft tumor, 3 cm. in length, of cauliflower appearance, found rising slightly above intestinal mucosa; in centre of this, the opening of the com.d. and pan.d. Micr.: carcinoma. Dur. 7 weeks. (Lannois and Courmont consider this a case of carcinoma of the pancreas.)

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TENDON FIXATION.

A PRELIMINARY REPORT OF A SIMPLE OPERATION FOR THE PREVENTION
OF DEFORMITY IN PARALYTIC TALIPES..

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DISSATISFACTION with the results obtained from arthrodesis, tendon transplantation and silk ligament installation led to the trial of the method which is here reported.

CASE I.—A. W., a boy eight years of age, had had anterior poliomyelitis six years ago, resulting in permanent complete paralysis of the right peronei muscles and partial paralysis of the dorsiflexors of the foot. Equino-varus resulted which was corrected in October, 1909, by forcible manipulation and tenotomy of the tendo Achillis. A stop joint ankle brace with an outside T strap was applied after the removal of the plaster of Paris and a splint was worn at night. Two years later the patient returned to the hospital with a recurrence of the varus deformity. The dorsiflexors had regained fairly good power and there was no further tendency to toe drop. Arthrodesis was then performed at the astragalo-navicular and calcaneo-cuboid joints, the varus being completely corrected. The operation resulted in solid union. Six months ago the patient returned to the hospital with a marked recurrence of the varus, the deformity occurring at the ankle joint. The ankylosis at the midtarsal joint was still quite firm, and as far as this joint was concerned, the contour of the foot was correct. The whole of the deformity was due to the pulling of the astragalus out of its socket. To overcome this deformity and to prevent its recurrence the following operation was performed.

A vertical incision, three inches in length, was made on the outer side of the leg, over the peronei tendons, extending downward to below the styloid process of the fibula. The tendon of the peroneus longus was freed by division of the upper part of

the external annular ligament, and displaced sufficiently far forward so that traction upon it produced dorsiflexion. With the tendon in its normal position, traction upon it would produce plantar flexion. A vertical incision two and a half inches long was then made through the periosteum of the anterior surface of the fibula down to the lower extremity of the bone. The periosteum was elevated for a quarter of an inch on either side of this incision and with a gouge a piece of bone, two and a half inches long and of the thickness of the peroneal tendon, was removed from the fibula. With the assistance of a pair of Kocher's clamps the tendon was drawn taut, thus dorsiflexing and abducting the foot, and the tendon laid in the trough prepared for it. Here it was securely fastened by a No. 1, thirty day chromic catgut suture, which caught the two edges of the periosteum and the tendon itself, completely covering the tendon with the periosteum for a distance of two and a half inches.

A similar vertical incision was made in the periosteum under the peroneus brevis, and this tendon treated as was the peroneus longus. The external annular ligament was now sutured with catgut and the skin closed with horse-hair. The foot was held in this correct position by a plaster of Paris bandage.

The reason for displacing the tendon of the peroneus longus forward was to prevent the production of a fixed equinus from the tightening of these tendons. By the new arrangement the action of the two peronei tendons balanced each other.

A month after the operation the plaster was removed. Healing had occurred by primary union and the foot was in good position and held firmly by the fixed tendons, although the strength of the fixation was not severely tested. Plaster was reapplied.

Nine weeks after the operation the plaster was again removed and the foot found to be held firmly in a correct position by the fixed tendons. The fixation was quite solid, as demonstrated by the fact that strong attempts to adduct the foot were unsuccessful. The range of voluntary and passive dorsiflexion was normal, while that of plantar flexion was limited about one-half by the fixed tendon.

For the past two months the patient has been walking without a brace and there has been no tendency to recurrence and so far the operation has been successful.

This operation has been performed on three other patients. One was a case of varus, similar to the case above; one was a case of equino-varus, with complete paralysis of the dorsi-flexors as well as of the peronei; and the last was a case of equino-valgus, there being complete paralysis of the dorsi-flexors and adductors of the foot.

Case No. 2 was identical with Case No. 1, except that in the former no previous operations had been performed.

In Case No. 3, in addition to the fixation of the peronei tendons, a similar fixation was performed on the tendon of the tibialis anticus, the tendon being buried under the periosteum of the tibia, on its anterior border. It is now four months since the operation, and there is no tendency to recurrence of the varus and plantar flexion is not possible past a right angle, owing to the fixation of the tendon of the tibialis anticus.

In Case No. 4 it was necessary to do a tenotomy of the peronei tendons as well as of the tendo Achillis. A fixation was then performed on the tibialis anticus as in Case No. 3, and in addition the tibialis posticus was dealt with in a similar manner, being buried under the periosteum of its own groove. The patient is now walking about with the assistance of a Whitman flat foot brace and as yet there is no tendency to recurrence of either valgus or equinus.

It is not to be expected that as much can be achieved by an operation such as that performed in Case No. 4, where the fixed tendon has to support the body weight, as from those operations in which the fixed tendon has simply to support the weight of the foot or to resist the tendency to contracture of antagonistic muscles.

In none of the cases has a longer time than five months elapsed since the operation, so that in no sense can this report be considered a report of final results. But if the fixation holds and the tendon does not stretch, this operation has the advantage of preventing the deformity in a manner which most closely resembles normal conditions. The results so far obtained are sufficiently encouraging to warrant a further investigation of this method of treatment.

THE END RESULT OF EXCISION OF THE ELBOW FOR TUBERCULOSIS.

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Lecturer in Anatomy in the University of Manchester.

My excuse, as an anatomist, for intruding on the domain of surgery in the clinical investigation of tuberculous joints, is the discrepancy in accounts by various writers of what is ultimately the state of the joint in the cure after operation on tubercular disease of the elbow. One rarely has the opportunity of thoroughly investigating the condition of a cured tuberculous elbow which has undergone treatment by excision. Such an opportunity having occurred in the department of clinical anatomy in the University of Manchester, I venture to give an account of the pathology of the case, in the hope that it may be of service to clinical investigators of tubercular disease of this joint.

In his recent book on joint tuberculosis Ely brings forward the suggestion that tubercular disease of a joint is invariably a disease of the synovia and red marrow.¹ On page 95 he states the following regarding the radical treatment of tubercular joints:

If the cure can be brought about by ankylosis or by dislocation, it . . . is not anything in ankylosis itself that brings it about but it is essentially the destruction of the joint.

The synovia and red marrow owe their presence here to function in the joint, and if function be removed they disappear. If they disappear, the disease cannot exist in that locality. Without them there can be no such thing as joint tuberculosis. . . .

Of the elbow . . . my specimens do not enable me to speak positively. Probably the matter stands as in the hip, that is, cure by fibrous union or by bony ankylosis.

Again, on page 175, this author makes the following statement in his description of tuberculosis of the elbow-joint:

¹ Ely: Joint Tuberculosis, 1911.

It would be interesting to find out whether the existence of a true joint here disputes our theory (*i.e.*, the formation of fibrous tissue which is immune) or whether, as in the ordinary cured tuberculous hip, there is really no joint at all and the bones are simply tied together by fibrous tissue.

Such a theory as that of Ely is a decided step forward in the better understanding of tuberculous joints, if it is found to be borne out by future investigations.

I do not attempt to criticise Ely's views on the subject, but merely to point out that an elbow may be completely cured of tuberculosis and yet not exhibit obliteration of the joint cavity and its replacement by fibrous tissue.

During the present year M. M., a female subject aged fifty-nine, was delivered to the anatomical department of the University of Manchester for purposes of dissection. As the body showed tubercular lesions and also the scar of old operation on the right elbow, it was handed over to the department of clinical anatomy for investigation.

Examination showed that there were active tubercular lesions in the right tarsus and the right side of the frontal bone. Considerable necrosis had occurred in the latter area and death was due to an abscess of mixed infection in the right frontal area of the brain. There was no sign of phthisis in the lungs, and the pleuræ showed complete absence of adhesions. Apart from the elbow the body exhibited no lesions worthy of note other than those just mentioned.

The patient had, at some previous date—which unfortunately was not ascertained in the hospital—suffered from tuberculous disease of the right elbow-joint and had undergone an operation for excision, concerning which no further details could be obtained. The operation had been entirely satisfactory. The disease had been completely eradicated, and the patient possessed a flail elbow, the arm and hand being still of service to her. The incision used had been a longitudinal one on the posterior and inner aspect of the joint—parallel to the course of the ulna nerve. This incision had been modified to a bayonet type by a smaller transverse cut on the extensor surface at the level of the lowest portion of the humerus. On making longitudinal sections of the

joint the operation was found to have partaken of the nature of partial, rather than of complete, excision. The olecranon had been entirely removed, together with the articular surface of the humerus. The coronoid process and the head of the radius had been left *in situ*. A joint cavity was found and contained a small amount of glairy synovial fluid. The portions of bone left had undergone osteoporosis and showed yellow marrow only. No osteophytic growths were present. The lower end of the humerus overlapped the ulna by 3.5 cm.

Fig. 1 shows a longitudinal section through the joint, while Fig. 2 is an illustration of a similar section made through the healthy left elbow-joint for comparison with Fig. 1. Dense fibrocartilaginous tissue covered the wasted coronoid process and head of radius. The capsular ligaments had been little interfered with except behind. Adhesions were numerous in the superior radio-ulnar joint. Synovial membrane appeared to line the joint cavity. Histological sections were therefore made to ascertain whether tubercle were still present and whether synovial membrane really did exist. The following is the result of the microscopic examination:

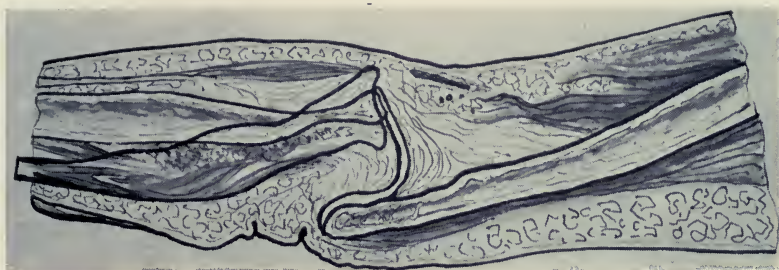
Sections of the joint lining adjacent to the sites where bone had been excised show a lining of synovial membrane and the formation of synovial villi. No giant-cells are present, the nearest approach to them being such an appearance as that figured at *a*, Fig. 3.

This, however, on closer inspection proves to be part of the wall of an obliquely cut blood-vessel. No lymphocytes are present in the tissues. Amyloid degeneration is nowhere to be found, though it was specially sought for. The walls of the blood-vessels are thickened and from the reaction of this tissue to eosin and acid fuchsin, it appears to be hyaline in character.

Thus the joint shows regeneration of synovial membrane and no evidence of active tubercular disease. Indeed the presence of hyaline degeneration is the only appearance which could be connected with the presence of old cured tuberculosis.

The result of the investigation of this case is not so satisfactory as could have been wished. This is the natural result of an incomplete operation. The case shows, however, that the cure of a tuberculous elbow by excision need not necessarily involve total destruction of the joint and its replacement

FIG. 1.



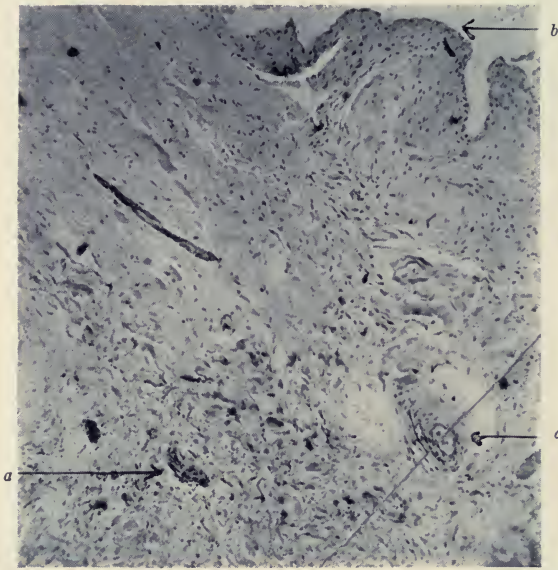
Anteroposterior longitudinal section through the right elbow-joint. The ulna has been outlined on the illustration to show its general appearance and its position relative to the radius. Lateral half of elbow region.

FIG. 2.



Anteroposterior longitudinal section through the normal left elbow-joint for comparison with Fig. 1. Mesial half of elbow region.

FIG. 3.



Section through joint lining at edge of resected bone. *a*, blood-vessel wall cut obliquely and simulating giant-cell formation; *b*, synovial edge; *c*, vessel cut transversely with some hyaline change.

by fibrous tissue. The age of the patient interferes with any inference drawn from the character of the marrow.

I am not disposed to regard this case as a controversion of the views suggested by Ely, in defence of which he has brought forward so much evidence.

I have described the case in view of the fact that it exhibited a healed tuberculous elbow in which a joint cavity was still present, and because opportunities of investigating such joints are comparatively rare.

Professor Elliot Smith kindly placed the subject at my disposal, and Professor Lorrain Smith gave me much useful criticism on the histology of tuberculous joints. To both of these gentlemen I would therefore acknowledge my indebtedness.

SUMMARY.

The end result of partial excision of the elbow-joint for the cure of tuberculosis may be perfectly successful and yet a joint cavity may remain.

The cure of such a case does not necessarily depend on the obliteration of the joint cavity and its replacement by fibrous tissue.

THE ARREST OF HEMORRHAGE FROM BONE BY PLUGGING WITH SOFT TISSUES.*

BY GEORGE TULLY VAUGHAN, M.D.,

OF WASHINGTON, D. C.

THIS method of arresting hemorrhage was first used by me some ten years ago, and I desire again to invite the attention of surgeons to its simplicity and efficiency. I have used it with satisfaction in a great many operations where bleeding from the bone was troublesome, as in fractures of the skull, sections of the skull for any purpose, as for tumor or Gasserian ganglion removal, amputations, resections, bone transplantation, and in osteomyelitis to prepare the cavity for iodoform or bismuth paste.

The method consists in cutting a fragment of soft tissue, muscle or fascia, preferably muscle, from any convenient place in the field of operation and applying the fragment to the bleeding surface or edge of the exposed, broken, or cut bone by means of the fingers. If the tissue does not adhere at once it should be rubbed into the bleeding area by some suitable instrument, as a knife handle, dissector, or chisel, so that the vascular openings in the bone become plugged with little fragments of soft tissue. The advantages are obvious—the material is always present, it does not require special preparation, it does not act as a foreign body, and, according to my experience, it is always efficient.

REFERENCES.

- Vaughan: Tr. Med. Soc. of Va., 1905, p. 359.
Ibid.: N. Y. Med. Journal, Feb. 17, 1906.
Ibid.: Journal Am. Med. Assoc., Nov. 9, 1907.
Ibid.: Deutsche medizinische Wochenschrift, Berlin, Dec. 12, 1907,
p. 2111 (abstract).
Ibid.: International Clinics, 1908, vol. iv, 18th series, p. 110.
Da Costa: Modern Surgery, 1910, Sixth Edition, p. 452.

* Read by title at the meeting of the Southern Surgical and Gynæcological Association, Dec., 1912.

AN OPERATING TABLE FOR USE IN ANIMAL RESEARCH.

BY KATHARINE STEBBINS,

OF NEW YORK.

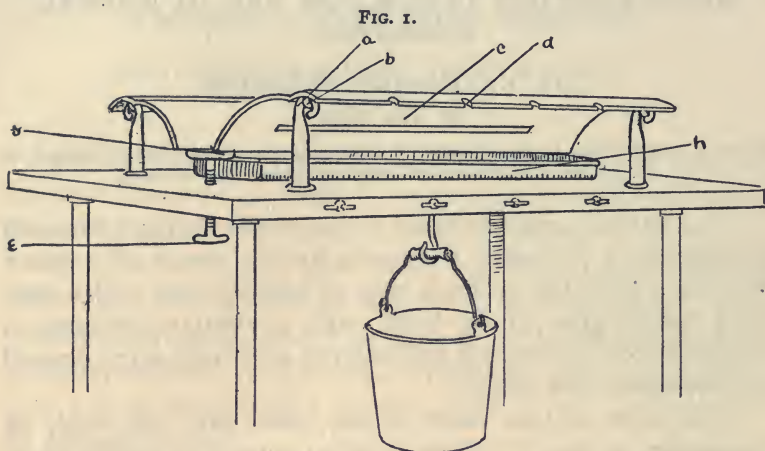
Nurse in charge of the Surgical Research Laboratory of the Department of Surgery, in the College of Physicians and Surgeons, Columbia University.

THE animal operating tables in use in the Surgical Research Laboratory of Columbia University are the result of a year's experience with the ordinary type of wooden rack and a constant consideration of its faults, with a view to producing a device of such construction and material as to meet every demand of convenience and asepsis.

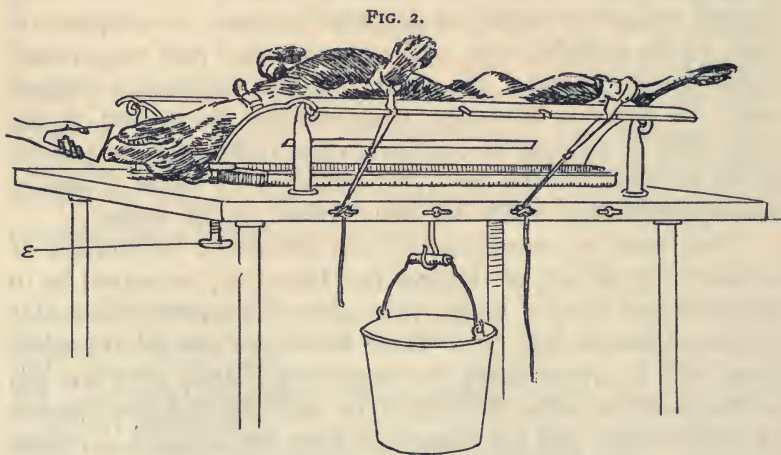
The most obvious faults in the usual rack are, first, its inflexibility, making it difficult to adjust animals of various sizes; second, the absorbability of the wood if unpainted, and the impossibility of covering with a paint which will not stick to the animals' fur when wet with chemicals or blood; third, the difficulty of convenient drainage; and, most important of all, fourth, the impossibility of being assured that the experiments are carried on under conditions of proper asepsis. In the use of dogs of the available type, where the skin and hair are particularly difficult to clean, the latter objection becomes a serious one. In order to overcome these various faults, and at the same time to produce an operating table sufficiently inexpensive to be practical for the research laboratory, the outfit shown in the accompanying sketch has been devised by the writer.

Four posts of enamelled iron are screwed to the surface of a table. At the top of the post is a hook (*a*), so curved as to interlock and form a hinge with a lug (*b*) on the under side of the adjustable leaf (*c*). These leaves are also of enamelled iron, with a groove along the upper edge fitting over the top of the posts, to make the hinge turn smoothly and give support at every angle, and are shaped to form the sides of a trough which receives the animal's body. On the upper edge of each leaf is a series of notches (*d*), through which pass the ropes for fastening the limbs, and which are made fast to small cleats on the edge of the table. The trough is made of the desired

depth, to fit any animal from a cat or rabbit to a large dog by adjusting a screw (*e*) under the table. This screw raises or



lowers a strong cross-bar (*f*) by means of a centre, and the lower edges of the leaves rest on this cross-bar. Two longitudinal slits in the leaves, and the aperture between the lower edges,



allow for drainage into a shallow pan (*h*) on the table. A pail hung on a hook beneath the table receives the drainage

through a hole in the pan and in the table. The *open* hinge permits the leaves to be entirely lifted off the hooks and thoroughly washed with antiseptics, or put into the steam sterilizer if desired, while the simplicity of construction makes every part of the table accessible for cleaning.

Fig. 1 shows the table as in use at Columbia University, but its form makes it equally desirable for physiological or pathological research. Fig. 2 shows a large dog anæsthetized and fastened to the table with the leaves at the lowest point, giving a trough five inches deep. By turning the screw (*e*) the trough is at once changed to a depth of two inches, if desired. The entire outfit of four posts, two leaves, screw, and drainage pan may be attached to any wooden table in a few minutes.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held December 11, 1912.

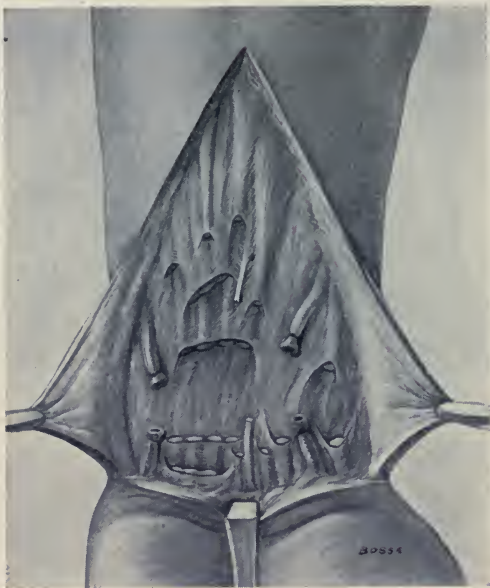
The President, DR. CHARLES L. GIBSON, in the Chair.

COMPLETE SEVERANCE OF ALL STRUCTURES ON THE FLEXOR SURFACE OF THE WRIST: TENORRHAPHY AND REPAIR.

DR. W. S. SCHLEY presented a man, 28 years old, who fell from a step-ladder through a glass door, and in trying to save himself thrust his arms forward. The right wrist came in contact with a sharp edge of glass, and every structure upon the anterior aspect was divided to the bones (Fig. 1). A nearby physician placed a tourniquet on the arm, and the man was sent to the hospital. After securing the ulnar and radial vessels, the wound was thoroughly irrigated with saline solution, and immediate suture of the divided tendons begun. To locate the retracted proximal ends and secure sufficient working space, a five-inch incision was made up the middle of the forearm, crossing the wound at its centre. Much difficulty was experienced in securing each tendon to its distal end, and the procedure was like trying to repair broken wires of a telephone switch-board. The median, radial and ulnar nerves were completely divided. The tendon sheaths were incised to secure the proximal ends, and the tendons were sutured with a mattress suture of fine silk. The divided ends of the median nerve were stitched with fine catgut. The ulnar and radial nerves were not sutured.

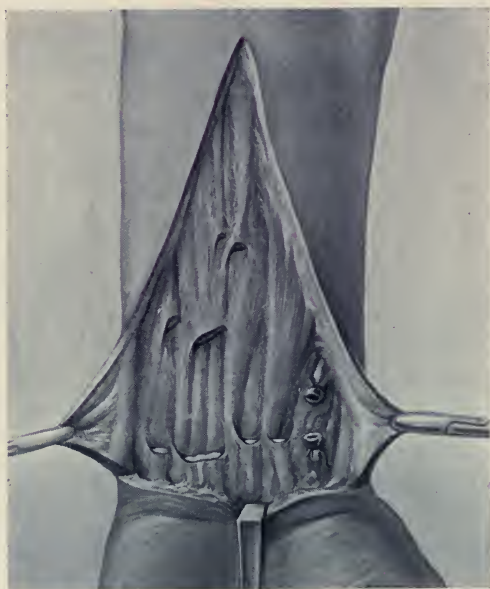
The forearm and hand were put up in half flexion and kept so for three weeks. Primary union resulted in the first week. The point of interest in the case was the very extensive injury, with practically complete restoration of function after seven months. For five months the resulting anæsthesia in the hand and fingers was the cause of many minor burns and injuries. At the present time, the atrophy of the thumb and little finger muscles was fast disappearing. There was some hyperæsthesia, and over the median nerve at the site of the injury there was a small, very sensitive mass, probably a neuroma or neurofibroma. No ulnar neuritis had developed. The circulation in the hand was apparently slightly interfered with following the division of the radial and ulnar vessels, although in cold weather the hand on the in-

FIG. 1.



Semi-schematic drawing. Severance of all structures on anterior surface of wrist.

FIG. 2.



Severance of tendons and superficial layer of wrist.

jured side suffered more than its fellow, and the circulation was not as good; this gave the patient but slight inconvenience.

COMPLETE SEVERANCE OF SUPERFICIAL LAYER OF FLEXOR TENDONS OF WRIST: TENORRHAPHY.

DR. SCHLEY presented a boy, ten years old, who while turning the knob of a glass panel door loosened a sheet of broken glass, which in falling passed across the anterior aspect of the wrist, half an inch above the annular ligament. The radial artery and all the superficial tendons were completely divided, and the median nerve was badly nicked (Fig. 2). The artery was ligated, and the skin wound was sutured by a physician, who gave a very bad prognosis as regarded function. When Dr. Schley saw the boy, a week after the accident, the wound had become badly infected. It was reopened, and about four weeks were allowed to elapse before it was thought safe to attempt tendon repair. An incision four inches long was made along the anterior aspect of the forearm, crossing the original cut, and as each divided tendon was found it was freshened and sutured to its distal segment with a single mattress suture of fine silk. The retraction of the tendons had been so considerable that the sheaths had to be incised. No attempt was made to do anything to the median nerve, as it had been only partly divided. The arm and wrist were then put up in half flexion. For three months following injury there was noticeable impairment of function of the thumb muscles—the opponens, abductor, and flexor brevis pollicis. Result perfect; motion as free and strong as before.

OSTEOPLASTIC CRANIECTOMY ILLUSTRATING THE USE OF THE DE MARTEL APPARATUS.

DR. JOHN A. HARTWELL, presented a man, 33 years old, who was admitted to the hospital on November 15, 1912, complaining chiefly of headaches and twitching of the right side. The history he gave was that seven weeks prior to his admission he was struck on the upper posterior portion of the left frontal bone with a heavy iron bar. He immediately felt numb and became unconscious, and when he awoke in the hospital six hours later he complained of feeling drowsy and had a sharp, lancinating pain in the left eye. He went to sleep again, and when he awoke, seven hours later, he had a very severe unilateral headache on the left side. During the first two days after his injury he suffered from nausea and vomiting, the latter being at times projectile in character. The headache gradually became less

severe, and the patient left the hospital 16 days after the receipt of his injury. On the afternoon of that day he had two attacks of dizziness and "giving way" of the right side, without premonitory symptoms. He did not lose consciousness entirely, but sank slowly to the ground and could not rise for four or five minutes. During the following six weeks he had about 15 similar attacks; these usually occurred in the afternoon, and were accompanied by aphasia. He usually fell to the right side, and after such a seizure complained of severe unilateral headache which persisted for the rest of the day and was somewhat alleviated by a night's rest. The patient also stated that about a week after the injury he became nervous and developed jerky twitching movements of the entire right side of the body. He described these as having their onset in the tips of the right fingers, and extending up to the arm and face and down the leg.

The headaches gradually became more severe and constant, and when the man returned to the hospital he was examined by Dr. M. Allen Starr, who expressed the opinion that the patient had an extensive cortical hemorrhage, with laceration of the meninges, and advised an exploratory trephine operation. In November, 1912, Dr. Hartwell, under gas and ether intratracheal anæsthesia, made an incision in the left temporal region, and then did an osteoplastic craniectomy, using the De Martel apparatus. There was very little bleeding from the bone, but considerable oozing from the surface of the dura, which was more adherent to the skull than usual. The dura was tense, but pulsating; it was incised and reflected, showing an apparently normal brain surface. The dura was sutured and wound closed. The patient made an uneventful recovery, and when he left the hospital, November 29, there had been no recurrence of his symptoms.

Dr. Hartwell also briefly reported a second case of osteoplastic craniectomy in which he used the De Martel apparatus. He referred to the ease and rapidity with which the skull could be opened by means of this instrument, and its comparative safety in guarding the dura from injury.

FRACTURE OF THE UPPER THIRD OF THE LEFT HUMERUS,
WITH A TRANSCONDYLOID FRACTURE OF THE
ELBOW: TREATMENT BY THE COMBINED
WHITMAN-JONES POSITIONS.

DR. H. H. M. LYLE showed a boy, five years old, who fell 20 feet, sustaining a fracture of the upper third of the humerus and

of both condyles of the left elbow. When he entered St. Luke's Hospital, 24 hours after the accident, the problem was to reduce and hold in good position the fragments of a bone which had been fractured at both extremities. The usual methods of holding the fragments were tried but gave disappointing results. Having observed the excellent results obtained by Dr. Royal Whitman in the treatment of epiphyseal displacement and fracture of the upper extremity of the humerus by assuring definite adjustment and fixation of the fragments, it was decided to treat the fracture of the upper third of the humerus in this manner, and the transcondyloid fracture by Jones's method of supination and acute flexion.

With the patient under ether, the fragments were separated, the upper fragment was grasped, and the arm slowly abducted to the extreme limit, the acromion serving as a fulcrum. The abducted arm was moved slightly forward, the forearm was supinated and acutely flexed. This position was maintained by a shoulder spica which extended from the wrist and inclosed the elbow, the arm, the shoulder and the thorax. Contrary to expectations, this position proved to be very comfortable, and at the end of four hours the swelling of the arm had disappeared. The bandage was removed on the 37th day, when both fractures were solidly healed and both joints allowed considerable motion. It was now a month since the bandage had been removed, and the boy had perfect functional use of both joints. A number of X-ray plates were exhibited by Dr. Lyle to show the anatomical results.

OBSTRUCTIVE JAUNDICE FROM AN IMPACTED STONE IN THE COMMON DUCT: PERTHES'S INCISION; CHOLE- CYSTECTOMY; CHOLEDOCHOTOMY.

DR. H. M. LYLE presented a woman, 57 years old, who entered St. Luke's Hospital on September 18, 1912, giving a history of gall-stones which extended over a period of 20 years. A year ago she had a severe attack of gall-stone colic, with a typical blockage of the common duct. Her jaundice still persisted and was now intense. She was weak and emaciated, and had lost over 60 pounds. A moderate grade of mitral insufficiency was present. The liver extended for two fingers' breadth below the free border of the ribs. The gall-bladder could not be palpated, and there was a marked diastasis of the recti.

The patient was regarded as a very bad surgical risk; it was reasonably certain that numerous adhesions would be encountered, and the conditions called for an incision that would give ample

room for rapid and thorough work. It was thereupon decided to employ Perthes's incision, which was hockey-shaped, the vertical arm starting in the median line just below the ensiform cartilage and descending to within two fingers' breadth of the navel; it then turned horizontally outward until the fibres of the external oblique were exposed. The anterior sheath of the right rectus was opened in the median line and the index-finger of the left hand inserted between the posterior surface of the right rectus and its posterior sheath. At the level of the transverse incision a double row of mattress sutures was inserted to bind the rectus muscle to the anterior sheath, the finger keeping the needle from penetrating the posterior sheath. The muscle was then cut transversely between the two rows of mattress sutures. The rectus muscle, bound to its anterior sheath, was then re-flexed upward over the free margin of the ribs until the two intercostal nerves were seen entering the posterior surface of the rectus. An oblique incision, one finger's breadth below these nerves and parallel to the free border of the ribs, was made through the posterior sheath into the peritoneal cavity.

The advantages of this incision, Dr. Lyle said, were: (1) It gave an excellent exposure; (2) no nerves were cut; (3) the suture of the peritoneum and the posterior sheath in oblique incision was simple and this line of suture covered by the rectus; (4) it yielded a strong abdominal wall; in the rectus he substituted an artificial transverse fibrous band if he did not go through a natural one; (5) it afforded opportunity for work on the appendix, etc.

Dr. Lyle said he felt that in this particular instance without such an excellent exposure he would have lost the case. The patient's general condition was critical, and the dense adhesions surrounding the common duct were difficult to handle. The gall-bladder was excised, a large stone was removed from the common duct and four from the hepatic duct. The common duct was drained. The patient made an uninterrupted recovery and now possessed a strong abdominal wall.

The transverse division of the rectus, Dr. Lyle said, was described by Sprengel before the German Surgical Congress in 1910. In the *Zentralblatt für Chirurgie*, No. 24, June 15, 1912, page 809, he described a method of making the suturing of the transverse wound easier. Perthes, in the *Zentralblatt für Chirurgie*, No. 37, pp. 1249-1252, still further improved this

portion of the technic, and in the same number of the *Zentralblatt* (pp. 1252-1256) described his incision for operations on the gall-bladder and ducts.

GASTRECTOMY; CHOLECYSTECTOMY; CHOLEDOCHOSTOMY.

DR. JOHN F. ERDMANN presented a woman, 68 years of age, upon whom he had operated four years ago for a hydronephrosis of the right kidney, which contained a large number of small calculi, sufficient to fill a six-ounce bottle. At that time he did a nephrectomy, also removing an ovarian cyst and the appendix.

The patient remained perfectly well until a year ago, when she returned complaining of severe gall-bladder colic, together with pain after eating, loss of flesh, etc.—symptoms which led to the suspicion of a neoplasm of the stomach.

On June 22, 1912, Dr. Erdmann exposed the gall-bladder through a median incision, doing a cholecystectomy for atrophied gall-bladder which contained 112 stones. He also did a choledochostomy, removing 68 stones from the common and hepatic ducts.

There was present also an extensive but freely movable cancer of the pylorus, and a pylorectomy and partial gastrectomy was done, four-fifths of the stomach being removed. The patient recovered rapidly, and had gained 13 pounds in a few weeks.

CARCINOMA OF THE STOMACH: GASTRECTOMY.

DR. ERDMANN presented a man, 46 years old, upon whom he operated on October 22, 1912, for an extensive carcinoma of the stomach, necessitating the removal of four-fifths of the stomach, with the pylorus. Recovery was perfectly smooth, and the patient had been free from symptoms since the operation.

This patient had presented mixed symptoms suggestive of both ulcer and carcinoma. The pathological report showed that cancer was engrafted upon an ulcer.

In reply to a question by Dr. Gibson, Dr. Erdmann said that in 21 gastrectomies recently performed he had done the posterior gastro-enterostomy 19 times, and the anterior but twice.

PERFORATION OF THE UTERUS DURING CURETTAGE, WITH PROLAPSE OF THE GUT, NECESSITATING THE REMOVAL OF TWO FEET OF INTESTINE.

DR. JOHN F. ERDMANN presented a young woman whom he was called to see about three hours after she had been curetted in a physician's office for a suspected miscarriage. The duration of

the pregnancy was not over eleven weeks. Upon examination, he found the patient in a fair degree of shock, with considerable abdominal distention and tenderness. A large plug of cotton was found in the vagina, upon the removal of which a mass was seen protruding which resembled the umbilical cord of a full-term child. This could be drawn out of the vagina for a distance of about a foot, and proved to be intestine denuded of its mesentery.

The patient was hurried to a hospital, and Dr. Erdmann did an abdominal section, an hour later. He found the abdomen filled with blood-clots and some intestinal contents. The cæcum was markedly infiltrated with blood, excepting its outer aspect, and the mesentery was torn loose from the ileum for a distance of over two feet from the ileocæcal junction. This loop of intestine had escaped through a perforation in the uterus which was large enough to admit the thumb. The uterus was soft and boggy and enlarged to about a two months' pregnancy.

A resection of the intestine was done within one inch of the ileocæcal valve, and this one inch inverted into the cæcum. The proximal excision was done an inch beyond the point of denudation of the mesentery, and an ileocæcal side-to-side anastomosis made. A subtotal hysterectomy was done, the posterior wall of the cervix was split, with free iodoform packing drainage. The patient was discharged, well, at the end of three weeks.

Dr. Erdmann said he could recall four additional cases of perforation of the uterus during curettage that came to his service for surgical attention. In one he did a hysterectomy on account of a large laceration of the uterus. In this case there were numerous contusions of the intestines, but a resection was not necessary. In the second case a hysterectomy was done, with the removal of twelve inches of intestine and the repair of a large rent in the bladder. This patient died. In the third case the tear was in the cervicocorporeal junction, with no marked evidence of peritoneal involvement. Under simple drainage the patient recovered. In another case the conditions were so grave at the time that no operative procedure was entertained, and the patient died within two hours after he saw her.

MYOSITIS OSSIFICANS TRAUMATICA; THE DIFFICULTY OF DIAGNOSIS FROM SARCOMA.

DR. WILLIAM B. COLEY read a paper with the above title, for which see page 305.

BOOK REVIEWS.

SURGERY OF DEFORMITIES OF THE FACE, INCLUDING CLEFT PALATE. By JOHN B. ROBERTS, A.M., M.D., Professor of Surgery in the Philadelphia Polyclinic. Large octavo; 273 pages; 273 illustrations.

IN this book the author has summed up the experience of a long professional life during which plastic work about the face has especially engaged his attention. Contributions of a minor character covering operations in this field have from time to time issued from his pen. One characteristic of Dr. Roberts' work, which has always impressed his colleagues, is his absolute honesty, so that when any one takes up a volume from his pen they feel sure that in it there is a plain and unvarnished tale in which both the successes and failures, merits and demerits of the various procedures described will be set forth. The author's style is plain and simple and his statements are so expressed as to convey their meaning to the reader without any question. The illustrations are abundant and have the rare merit of aiding the reader to understand the text. The author devotes two initial chapters to a historical account of the development of plastic surgery in general, then, after a survey of the anatomy of the face and the characteristics of the surgery of that region, he proceeds to a study of the principles of the special plastic procedures involved in the surgery of the region. Naturally the greatest interest in the surgery of this region attaches to the correction of harelip and cleft palate. The author devotes two chapters to this subject. His treatment of the subject is full and in general most satisfactory, but we could wish that he had emphasized with more detail the importance of preserving the intermaxillary bone. In the work of inexperienced surgeons,—and it is for them that this book is written,—this troublesome protrusion is too often sacrificed, because its importance for the future development of the jaw and for the prevention of most lamentable disfigurement, notwithstanding the repair of the fissured lip, is not sufficiently realized. A set of illustrations showing the later conditions produced by the loss of the intermaxillary

segment would not be difficult to get and would be most instructive. We do not wish to be considered as saying that the text anywhere suggests the sacrifice in any case of the protruding intermaxillary segment, but merely to express our opinion that it is an element in the subject which cannot be too fully dwelt upon. The importance of repairing by stages the more extensive defects of the palate and lip in the new born, also, cannot too strongly be set forth. This is well stated in the recapitulation which the author gives at the close of his discussion of the various operative stages required for the complete procedure which, as he says, may occupy a year or two during which many periods of inactivity are furnished in order to insure safety to the child and permit the surgeon to see the effect of the various stages of his operative work.

Deformities of the nose with rhinoplasty receive full attention, and here we recognize the result of the special interest with which the author has followed the surgery of this region for so many years.

The book as a whole is of great interest, and we are indebted to the author for giving to his colleagues this valuable summary of the work of a long professional life. LEWIS S. PILCHER.

DEFORMITIES INCLUDING DISEASES OF THE BONES AND JOINTS.

A Text-book of Orthopædic Surgery, by A. H. TUBBY, M.S. (Lond.), F.R.C.S. (Eng.). Second Edition. Macmillan and Co., London and New York.

The first edition of Tubby's book appeared fourteen years ago. It represented the English point of view, that orthopædics was concerned with the treatment of actual deformity only. That this convention no longer holds is evidenced by the fact that nearly a quarter of the book is devoted to the affections that lead to deformity, notably diseases of the bones and joints, in which rational and timely treatment may prevent the otherwise inevitable distortions.

The work is divided into ten sections. Five are included in the first volume under the titles of congenital and static deformities, and diseases of muscles, tendons, and fasciæ. In the second, are diseases of the bones and joints and paralytic deformities.

The author states that he has discarded the regional arrange-

ment in favor of the more scientific classification on an etiological and pathological basis. As deformities have such diverse causes, no arrangement can be perfectly satisfactory, and from the practical diagnostic and therapeutic stand-point, it may be questioned if the present classification, which requires so much repetition, has any advantage. For example, static deformities are considered in Volume I, and rickets, one of the most common causes of static deformities, in Volume II. The treatment of acquired talipes, usually caused by paralysis, is discussed in Volume I, while paralytic affections, including operative treatment by muscle transplantation, of which the chief value is in the treatment of distortions of the feet, are in Volume II.

As contrasted with the first edition, the contents of the two volumes are almost encyclopædic in range, and together with the illustrations it has been drawn from all sources, this country furnishing by far the largest proportion. It has been the author's intention to prepare an account of orthopædic surgery as it stands to-day, and he has presented the representative material so impartially that his own views and practice are not always well defined. It is evident, however, that he does not favor plaster supports. The Calot modification of the plaster jacket, generally recognized as a more efficient appliance than the original form, particularly in the treatment of disease of the upper and middle region of the spine, is not mentioned.

The various forms of plaster spicas used in the treatment of hip disease are not described. The author favors the Thomas brace, which is rarely applied in this country, and he describes at some length certain of the traction braces at one time a routine in treatment, but now in great degree displaced by apparatus that assures better fixation of the joint.

The author condemns the Mikulicz operation for torticollis, and prefers in certain instances the gradual rectification of deformity after tenotomy to immediate overcorrection.

Some of the operations described for the correction of deformity might be omitted with advantage; for example, that of Ogston for knock-knee, by separation and displacement of the internal condyle of the femur, which, it may be assumed, has long since been discarded. On the other hand, there is no note of the operative treatment of Pott's disease for the purpose of inducing ankylosis at the seat of disease, which is at present

attracting much interest. It is true that the first paper on the subject is not yet two years old, but the article by Lange on buried metallic supports in which the question of bone transplantation is discussed and which is undoubtedly entitled to priority, in suggestion at least, is of much earlier date.

The Abbott treatment for lateral curvature of the spine which bids fair to displace all other methods of treating fixed deformity, first described in June, 1911, has also escaped the author's notice. That two methods of treatment should have not only been suggested but sufficiently tested as to assure for themselves permanent places in practice, since the completion of this book, is gratifying evidence of the activity in this branch of surgery in this country.

The figures are numerous and well chosen to illustrate the diseases and deformities, and the methods employed in treatment. The bibliography is accurate and complete.

The size and cost of the work and its method of construction may limit its availability as a text-book, other than for reference, but it is heartily recommended to those who may have especial interest in or some knowledge of the subject. The author states that if he had appreciated the magnitude and difficulty of the task, it is possible that his courage would have failed. One may congratulate him therefore upon the very satisfactory result of his labors.

ROYAL WHITMAN.





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